ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

ARCHITETURAL ASSESSMENT TO EMERGENCY HOUSING PATTERNS

M.Sc. THESIS

Mahsa SAFAEI

Department of Architecture

Architectural Design Programme

Thesis Advisor: Prof. Dr. Yurdanur Dulgeroglu Yuksel

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

ACİL KONUT MODELLERİNİN YAPISAL OLARAK DEĞERLENDİRİLMESİ

YÜKSEK LİSANS TEZİ

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Mahsa-safaei, a **M.Sc.** student of ITU **Graduate School of Architectural Design** student ID **502091103**, successfully defended the **thesis** entitled **ARCHITETURAL ASSESSMENT TO EMERGENCY HOUSING PATTERNS**", which she prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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To my Parents,

FOREWORD

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May 2012

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ABBREVIATIONS

UNHCR : The United Nations High Commission for Refugees
OXFAM : Oxford Committee for Famine Relief
CCS : Concrete Canvas Shelter
GVS : Global Village Shelter
LWET : Light Weight Emergency Tent
CMU : Concrete Masonry Unit
SIP : Structural Insulated Panel

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ARCHITECTURAL ASSESSMENT TO EMERGENCY HOUSING PATTERNS

SUMMARY

The project is focused on the concept of housing and its newborn notion *Emergency Housing*. Being basic human need, the importance of housing cannot be ignored (Guido Francescato, 1993). It is everyone's right to have a roof over head to keep him/her from dangers and weather. People need shelter to protect their health, esteem and privacy. As time passes, they upgrade their shelters for more comfort regarding aesthetic aspects. This is a historical process by the aid of no architect. Since the dawn of architectural science, numerous styles and patterns have been growing up by many architects to reflect people's need and expectations of a better shelter. Therefore, shelter need is a repetitive story growing rapidly that accentuates the important role of prefabricated and modular systems in accelerating the construction process. Increasing disasters, wars, low quality houses, migration etc. have increased and provoked need of shelter in the 20th and 21st centuries by far much than before.

In some cases of disasters, the loss of housing destruction is multi-faceted which leads to homelessness especially in vulnerable zones with feeble economy, informal settlements located in unstable areas, high risk, whose buildings and lack of appropriate techniques in general. The contribution of the disasters has caused subsequent secondary problems such as deterioration of the environment and its identity, displacement, tragedies, uprooting of the settlers, damage and destruction of the habitable structures and public infrastructure. This adverse condition requires prompt action to refuge people. To act swiftly and rescue the life of people immediately *"Emergency Housing"* has been born.

Critical conditions require adequate emergency housing, but adequate shelter means more than a roof over one's head. It also means adequate privacy, adequate space, physical accessibility, adequate security, security of tenure, structural stability and durability, adequate lighting, heating and ventilation, adequate basic infrastructure, such as water supply, and sanitation. This sophisticated situation has concerned experts of different fields especially in the last decades to improve the aspects of emergency housing and due to the diversity of the problems; different types of Emergency Housing with various concepts have come to birth. The main matter is that majority of the shelters are patented without considering their future effect on People, Environment and Architecture of housing in long-term use. An Inconvenient shelter example is the one used for 2005 hurricane in *New Orleans* that people had to stay in shelters for less than a year were made live there over three years in a very unsafe condition. This advent sample shows the mismatch of shelters with the condition happened that might lead for subsequent problems. Besides, people's expectations about the shelters have changed and we are being forced to rethink shelter, aiming to improve quality and enhance accountability. Regarding these problems, this dissertation cares about the emergency housing examples all over the world to make a comparison among them, in order to see which ones have been more

successful and effective. The alternatives are chosen among those more popular and innovative examples regarding both local and modern architecture. Since the majority of the struggles have focused on the recovery and management phase of the crisis to relieve people of calamity, this survey would be an architectural assessment, considering issues related to architecture. Emergency housing is a vast notion comprising of various types. This dissertation concentrates on various categories of emergency shelters in which time is an essential factor and people need to refuge as an emergency at different intervals. The period use of these shelters varies between three days to sixty years according to the condition. The assessment on the emergency housing will help to the emergency shelter building community to satisfy both people and designers. They should be environmental – friendly with respect to durability to avoid future calamities. Since they are emergency shelters, there would be less care about providing a community attachable to the city texture and prefabricated system would be an alternative to handle the situation. For longer accommodation, temporary housing, local architecture can affect the shelter condition. Self-construction and incremental buildings are other solutions to improve shelter and houses, but they are with ills and problems. Sheltering is a multi-faceted issue and cannot be resolved by only considering one solution. Different conditions regarding country, culture, economy, tradition etc. have deep influence on the type of shelters. Considering this issue, the assessment of the present emergency housing examples alleviates users' choice in selecting the most suitable shelter. The assessment is through the method of comparing the various types.

Broadly spoken, the community of shelter making is growing bigger to provide adequate shelters for the vast demands, which have leaded to creation of various shelters. The evaluation of each shelter category on the advantages and disadvantages can improve the perspective for future shelter building and help to decide on designing a more suitable shelter for an emergency.

For upcoming program, maybe a guidebook indicating emergency housing patterns can be provided to pave the way of housing for constructors and users. The assessment will lead to future possible patterns of emergency housing applicable in different conditions that may act like a guide for architects and people both to response promptly to the shelter need.

It will be a guide that would deem people's expectations and simultaneously look forward to the future of the city texture, which affects environment and people's life both.

The results of this dissertation do not discuss about a designed plan. It just provides clues to design various rapid housing with satisfactory conditions with the aid of people and architects.

In this thesis, the emergency housing is categorized into four groups. Each group is sub categorized into groups with the parallel concepts. In each group, examples with the parallel concept will be compared with each other considering time and quality of the shelter.

For the quality of the shelter, undependable items including architectural aspects, environmental performance and comfort would be analyzed. Afterwards, each item will be scored to see which one has the most effective role in confirming the concept and basic idea of the shelter.

ACİL KONUT MODELLERİNİN YAPISAL OLARAK DEĞERLENDİRİLMESİ

ÖZET

Tezde konutlandırma ve bu kavramın bir düşüncesi olan *acil konut* fikri üzerine odaklanılmıştır. Kötü hava şartlarından ve tehlikelerden korunmak için herkesin bir çatı altında yaşamaya ihtiyacı vardır. Ayrıca insanlar sağlık ve özel hayatlarını korumak için mutlaka bir barınağa gerek duyarlar. Zaman geçtikçe estetik ve konfor açısından gelişmişlerdir. Ancak bu süreç mimarinin yardımı olmadan gelişen bir süreçtir. Uzmanlar insanların barınak ihtiyaçlarını yansıtmak amacıyla mimari bilimin ufak bir kısmında çok çeşitli stiller ve şablonlar geliştirmektedirler. Bu yüzden barınma ihtiyacı; prefabrik ve modüler sistemlerin önemini vurgulayarak inşaat sürecini hızlandırma aşamasında kendini tekrarlayan ve hızla gelişen bir hikayedir.

Afetleri, savaşları ve standartları ev sayılarının 20. ve 21. yüzyılın barınak ihtiyacını bir hayli artırmıştır. Bazı durumlarda kayıp, özellikle zayıf ekonomisi olan yardıma muhtaç bölgelerde, uygun olmayan yüksek riskli arazilere yapılan kaçak yerleşimlerde göze çarpmaktadır.

Ayrıca bu bölgelerdeki inşaatlar uygun teknikler kullanılmadan ve önceden belirlenmiş özel minimum sismik dirençlere uyulmaksızın yapılmıştır. Felaketlerin artması bölgenin yıkımına, bölge halkının köklerinden kopmasına ve manevi olarak zarar görmesine, yaşanabilir alanların ve altyapının yok olmasına sebep olmuştur. Kötü şartlar insanların hızla sığınacak bir yer bulmalarını sağlamak amacıyla acil çözüm gerektirir.

Daha hızlı hareket etmek ve hayat kurmak düşüncesiyle de *Acil Konut* kavramı oluşmuştur. Kritik şartlar acil konutların yeterli oranda yapımını gerektirir. Ancak burada barınak terimi yalnızca bir kişinin başını sokacağı bir çatıdan daha fazlasını ifade eder. Ayrıca bu şartlar; yeteri kadar mahremiyeti, yeteri kadar toplam alanı, fiziksel olarak kolay ulaşılabilir olmayı, yeterli güvenliği – mülkiyet güvenliği-, binaların sağlam ve dayanıklı olmasını, ısıtma, aydınlatma ve havalandırmasının iyi yapılmasını, su kaynakları ve bunları sağlıklı bir hale getirildiği durumda olduğu gibi basit bir altyapıya sahip olması gerektiğini ifade eder.

Bu tür karmaşık durumlar, ve özellikle son on yıldır değişik alanlardaki uzmanları endişeye sürüklemiş acil konut yapma fikrini geliştirmek istemelerine yol açmıştır. tiplerde acil konut yapımı gibi çeşitli düşüncelerinden dolayı.

Asıl önemli olan şudur ki, konutların birçoğu uzun kullanım sonunda insan, çevre ve mimari üzerine gelecekteki etkileri göz önüne alınmadan inşa edilmiştir. 2005 yılında New Orleans 'da ki hortum sonrasında geçici konutlarda bir yıldan daha az süre kalmaları gereken insanlar güvensiz bir alanda 3 yıldan fazla yaşamışlardır. Bu örnek hala en uygun barınağın tam anlamıyla yapılamadığını işaret eder.

Bunun yanı sıra, insanların barınaklar hakkındaki beklentileri zamanla değişmiş ve bu değişim barınakların kalitesini ve hesaplanabilirliğini artırmak amacıyla tasarımcıları yeniden düşünmeye zorlamıştır. Bu problemlerle bağıntılı olarak; bu

tez, aralarında bir karşılaştırma yapabilmek ve hangisinin daha başarılı ve etkili olabileceğini gösterebilmek için dünyadaki bütün acil konut örneklerini ele alır. Alternatifler, hem yerel hem de modern mimari hakkındaki daha popüler ve yenilikçi örneklerin arasından seçilmiştir. Bütün çabanın insanları felaketten kurtarmak için yeniden inşa etmek ve kriz zamanında yönetim üzerine odaklanmış olması sebebiyle bu değerlendirme mimari bir fikir oluşturmuştur. Acil Konut kavramı çok geniş, çok çeşitli ve kapsamlıdır.

Bu tez yalnızca bu tip zaman faktörünün önemli olduğu ve insanların acilen sığınacak yere ihtiyacı olduğu durumlardaki acil geçici konutlar göz önüne alınarak yazılmıştır.

Genellikle geçici konutların kullanım süresi 10 yıldan azdır. Acil konutlandırmanın değerlendirilmesi hem tasarımcıları hem de insanları memnun ederek acil konutla ilgilenen firmalara yardımcı olacaktır. Ayrıca bu konutların çevre dostu olmalarıyla birlikte gelecekteki afetleri atlatabilecek kadar sağlam olmaları da önemlidir. Acillikle alakalı olmalarından dolayı şehir dokusuna eklenmeleriyle eksiklik olabilir ve bu durumu prefabrik sistemler role gidirilebilir.

Daha uzun bir konaklama için, geçici evler, yerel mimari sığınak şartlarını etkileyebilir. kendi kndine yardımla yapı yapma ve zaman içinde büyüyen ve gelişen yapılar yapma konutlandırma işlemlerini geliştirmek için kullanılan diğer yöntemlerdir ancak bunlar problemli yöntemlerdir. Geçici konut çok yönlü bir konudur ve yalnızca tek bir yöntemle çözümlenemez. Ülkelere ilişkin farklı şartlar, kültür, ekonomi, gelenekler vb. etkenler geçici konut çözüm yollarını etkileyen faktörlerdir. Bu konu göz önünde tutulursa, bugünün geçici konut örnekler kullanıcıların en uygun konutu seçmelerini kısıtlamaktadır. Değerlendirme tipler arasından mukayese metodu ile sağlanmaktadır.

Kısaca söylenen; geçici konutla ilgili olan firmalar çok çeşitli geçici konut sağlanmasını gerektiren büyük talebi yeteri oranda karşılayabilmek amacıyla günden güne büyümektedir. Her bir geçici konutun avantaj ve dezavantajlarının sınıflandırılması gelecekteki konutlara bakış açısını geliştirebilir ve acil bir zamanda uygun olan konutun hangisi olduğuna karar verebilmeyi kolaylaştırır.

Geleceğin planlaması için; geçici konut şablonlarını içeren bir rehber kitapçık inşaatçı ve kullanıcılara yol göstermek amacıyla sağlanabilir. Değerlendirme; gelecekteki olası geçici konut şablonlarının farklı şartlarda hem ihtiyaç sahiplerine hem de mimari ile ilgilenenler acil durumda cevap vererek bu şablonların uygulanabilir olmasını sağlayacaktır.

İnsanların beklentilerini karşılayan ve hem çevreyi hem de insanların yaşantılarını etkileyen ve dört gözle beklenen bir rehber olacaktır.

Bu tezin sonuçları, tasarımcıları specifi bir plana götürmüyor. Yalnızca, mimar ve kullanıcılara yardım etmek ve kısa zamanda kullanıcısını memnun edecek çeşitli tip konutlar tasarlamak için ipucu sağlar.

Bu tezde, acil konut dört gruba ayrılmıştır. Her grup paralel konseptleriyle alt gruplara kategorize edilmiştir. Her altgrupta, ortak konseptli örneklerde zaman ve kaliteyi ele alarak birbiriyle karşılaştırılacaklar. Zaman alternatifine rağmen, barınak kalitesini incelemek için, bazı bağımsız alternatifler “mimari yönler, çevresel performans ve konfor itemleri” kapsayarak, analiz olacaktır.

Daha sonra, hangi barınağın daha çok tasarımcının konseptine uygun ve hangi barınağın afetin farklı koşullarında daha etkili bir rolü olacağı incelenecektir. Bunun için, her iteme (mimari yönler, çevresel performans ve konfor) örneklerdeki tecrübelerini ele alarak, puan verilecektir.

Verilen puanlar bir ve üç arasındadır. Üç en iyi ve bir en kötü olan durumları anlatıyor iki ise itemin normal etkisini göstermektedir. Bu puanlar tezdeki itemler bakımından (mimari yönler, çevre performans, konfor ve zaman) bir değer ifade edecektir. Tasarımcı yada barınağın mimarı kendi inşaa alanının koşullarına verdiği nota göre daha iyi bir barınak tasarlayabilecektir.
Son olarak, bu değerlendirmeler bir model gibi kullanılabilir. Bu tez belli bir acil konut planını anlatmıyor. Her mıntıkanın kendi için farklı koşulları olduğu için, bu modeller ileride sadece daha iyi tasarlamaya yardımcı olabilir. Böylelikle, her alanın bu modelleri kullanarak, kendine göre özgün bir planı olacaktır. Bu plan ve tasarım kullanıcı ve mimarı daha da çok memnun edebilir.

1. INTRODUCTION

Emergency housing is not a new issue and is considered as the basic human need that is sorely required in a variety of adverse conditions that people inevitably need to find a harbor to live in. The increasing tragedies like abused women, squatter housing, runaway migrants, disasters, and etc. in which people get homeless or live in an risky condition, have made the experts of any field realize the significance of the Emergency Housing. Based on this matter, numerous papers have beckoned methods of improving Emergency Housing. Being developed in a restricted period, the constructors and designers rarely pay attention to the quality of a shelter that would finally deteriorate the urban order, human health both physically and spiritually as well as the natural environment. Yet the shelters all are indicating the human need; therefore, they need to be evaluated. Due to the pretty concerns about the quality of the Emergency Housing, many proposals have been developed to revise the previous constructions; Japan especially has done a great effort using the latest technologies. Thus, currently architectural attention is focused on safety and comfort of the houses creating Emergency Houses that can be implemented everywhere whether prefabricated or local. The other struggle is to extract the main point of a determined zone and design only for that place only and there is not a broad and single definition of the shelter functions, further than considering the achievements of the new houses.

This thesis undertakes a theoretical reflection on emergency housing, to understand the factors that define the necessity of provisional refuge of individuals, emergency action, and advent of the patterns to develop the quality of life. The attention is centered in interpreting the specifications of the current examples of constructed emergency housing in order to inquire to favorable exclusive assessment of emergency temporary housing. The displayed arguments and review of projects implemented lately will allow us to define policies and to infer some conclusions of a language defining “emergency housing”.

1.1 Purpose of Thesis

The main target of this thesis is to evaluate the current or more preferred examples of emergency housing with an architectural perspective to find out what is typically being done in shelter building community. Therefore, the survey targets assessing properties and patterns of adequate affordable shelter with the possible high quality that can be provided at the least course of time.

1.2 Statement of the Problem

Despite enormous challenges to provide a complementally convenient shelter in an emergency, most of the sheltering projects have deficiencies in responding users' requirements. Modern prefabricated architecture; local and traditional architecture, incremental housing, and self-help are not implemented solutions developed for everywhere and are dependent on several conditions. Many like the example in hurricane 2005, New Orleans, have not been successful. Moreover, people's expectations about the shelters have changed in terms of sheltering definition. Therefore, we are being forced to rethink shelter aiming to improve quality and enhance accountability**.**

1.3 Methodology

The method is to compare different kinds of emergency shelters available with one another. The research is mainly based on primary data collection method. Moreover, in order to support data some secondary sources like books, journals, magazines, reports and publications have also been used. It is virtually comparing the existing emergency housing examples of the two categories of emergency housing: emergency shelter and temporary shelter. These examples are whether accepted worldwide or innovative ones. For the evaluation, examples with the same concept in each category will be compared with each other to target the main aim of similar examples. Although emergency housing is a multidisciplinary issue, architectural aspects like plan, terrain, form, orientation, environment effects, energy efficiency and etc. pertaining to the shelter and its reflect on the people and environment will be the subject of concern in this thesis.

1.4 Outline

This dissertation is arranged into the following chapters: chapter one is devoted to introduction, purpose of study, statement of problem and methodology. Chapter 2 indicates Annotated Bibliography, Emergency Housing crisis and ills have been investigated and then the related effects of these contexts discovered in the thesis. In chapter three terms and words used more frequently in this study is discussed. In this chapter, the overall explanation of Emergency Housing and its causes will be closely presented to provide a wide imagination of Emergency Housing and its concepts. Chapter 4 is dedicated to examples of the both categories (emergency shelter and temporary shelter). Each example is identified by its specifications and case studies.

In the following chapter (five), the data derived from chapter four is assessed to familiarize people and architects with innovative or the most recent technologies and concepts in the world. Chapter 5 is dedicated to the evaluation of the examples with similar concepts and chapter 6 is belonging to the conclusion of the survey.

2. STATE OF ART FOR EMERGENCY HOUSING

2.1 Purpose

Approaching the problems regarding Emergency Housing causes and considering the growing demand on housing and shelter, remarkably vast attempt of multi-disciplinary surveys have been done. Thus, it is wise to look into the research undertaken under the topic of Emergency Housing. In this respect, this chapter commences by posing the aim of analyzing several books, lately written dissertation and papers to come across with the most relevant difficulties of the Emergency Housing and revising and improving strategies proposed by the specialists and academicians. To figure out the related problems announced by my thesis with the previously undertaken surveys, it is necessary to look into the arts and hold their experiences and advises. Besides, the problems that have been ignored would be contemplated. Therefore, in this stage there is a brief look to the recently conducted researches.

According to (Dalton McCrary, Q. 2008), homelessness has been transmitted to a nightmare in the 21st century from the 20th century and it must be ceased. He is surveying root causes of chronic homelessness in Lawrence to overcoming adverse condition homelessness, introducing systemic and individual-based as two main factors of homelessness. Systemic discourses about the causes of homelessness generally focus on structural inequality and flaws in the socio-cultural-economic system. He debates that the contemporary homelessness is generated by the phenomena of unemployment, underemployment, and lack of welfare reform. On the other hand, the individual-based causes in his research can be explained by personal choice, laziness, irresponsibility, bad luck, addiction to alcoholism, and crime. Merging the main cause of homelessness- systemic (specifically wages, housing, and social flaw) and individual (mainly character flaws such as addiction and laziness)- a safe and comfortable shelter system is presumed to be concerned with issues of economic rehabilitation and re-socialization by building confidence and self-esteem of the homeless community. Whereas in Lawrence, staff members and administrators

in shelters with excessive punitive rules, video surveillance (keeping a nighttime monitor in the sleeping room overnight), and restricted access to services would place more emphasis on individual-based causes. Broadly spoken, "The homeless" were revealed to as more than just people without a home. Public and private research has shown homeless people in Lawrence are mentally ill, alcoholic, lack certain social skills, are trapped in generational poverty, and their conditions are exacerbated by various structural deficits in the community. Shelter staff and board members perceptions through these causes are helpful in developing certain policies of sheltering for reducing homelessness.

The second referece belongs to (Stinson, R.F. 2010). This research study serves the emerging body of literature on the reasons for homelessness and on the ways; counselors can be helpful to homeless people. Moreover, these results may benefit mental health clinicians in better understanding and better treating the problems faced by people who are homeless. As this dissertation points out, homelessness is a serious problem in the United States. In the opinion of this author, homelessness is a social justice issue that necessitates a social justice response.

Stinson like McCrary condemns individual and systemic causes for the growing homelessness in this paper. While some researchers assert that homelessness is caused by systemic problems such as low minimum wage and lack of affordable housing (e.g., U.S. Conference of Mayors, 2006), others argue that homelessness is an outcome of individual factors such as substance abuse and mental health problems (e.g., U.S. Department of Health and Human Services, 2003). Depending on the societies' conditions, sub-titles of each factor changes. Meanwhile he claims that there should be councilors to soothe and aid homeless society, whom people can rely on much to discuss about their main reasons of their homelessness. Francis found 146 incidents for homelessness in Iowa City, Iowa and announced seven of them of great importance, ordered of most cited to least cited were Employment, Finances, and Resources; Interpersonal Incidents; Substance Abuse; Significant Difficult Events; Illness; Legal Problems; and Choices. Holding these conclusions Stinson asserts counselors can find ways to improve the life of homeless people.

Frimpong A. 2010 in his thesis named Recovery after Disasters: Improving the Patterns of Sheltering and Housing for Impacted Victims, argues that current practices in disaster housing vary, based on the nature and scope of a disaster and can

range from providing short-term shelters to arranging temporary and in some cases, permanent housing. These challenges are exacerbated when impacted victims are displaced from their homes for longer periods and temporary housing must be provided.

The purpose of this case study research is to examine the provision of emergency shelter, temporary shelter, temporary housing and permanent housing in the aftermath of disasters and identify ways to improve upon delivery.

Frimpong accentuates the significant role of sheltering and housing in the disaster recovery process. He tries to figure out problems involved in the implementation of recovery programs and bring in new patterns for improving delivery in Ohio State, United States, known with disaster familiar zone especially flooding`.

Then the author takes a brief consideration to the duties of FEMA to highlight its position in the survey. Agency (FEMA) is comprised of four phases: pre-disaster mitigation planning; preparedness; emergency response; recovery, and reconstruction (Haddow and Bullock, 2003). Recovery is post-disaster activities designed to restore basic services, including repairing lifelines such as power and water; it includes temporary housing, food and clothing, debris clearance, psychological counseling, job assistance, and loans to restart small businesses (Quarantelli, 1982 & Waugh, 2000). Frimpong targets the function of FEMA in the sheltering recovery phase, which is often done in partnership with the American Red Cross (ARC). FEMA can provide temporary housing in the form of direct assistance or rental assistance for people fixing up their homes following a disaster.

He then blames inefficiency of FEMA other federal agencies in providing prompt sheltering of disaster victims. He argues FEMA and federal agencies has failed in managing Hurricane Katrina recovery in 2005 which hit the Gulf Coast that was reported the most expensive disaster in the American history. Three year after the disaster people still lived in temporary inconvenient shelters, which show FEMA's improper managing. In addition, its earlier failure in responding Hurricane Andrew in the time of Bush II presidency accentuated its incompetence. More criticism followed with the slow federal responses to Hurricane Iniki in Hawaii and to Loma Prieta earthquake in 1992. As a result, Frimpong asserts the need of qualified expertise for the head of FEMA's charging and the necessity of fundamental changes

in the values of the organization. To achieve this aim, he tries to gain the precious experiments of the federal agencies' managers to present a reliable solution.

Paraphrasing (Ernesto G. A. 1993), the author draws the reader's attention to the meaning and use of housing, claiming "Meaning and use are intertwined" that must be measured synchronically in designing... The house is a text, which provides sheltering of dangers and the weather, a complex entity that defines and is defined by cultural, socio-demographic, psychological, political and economic factors. Simultaneously, it points to the way in which our personal and social identities are shaped through the process of dwelling."

Role factors in an effective housing in his view are the resident, designers, architects, planners, politicians and engineers influence in constructing buildings. Therefore, there must be criteria to organize all these factors to make a favorable interaction among them to design.

He categorizes housing into two opposite groups: institutional housing and residential housing. Institutional housing, where inhabitants are transient boarders as illustrated by monasteries, hospitals, army camps and various kinds of 'social housing' where everyday life happening, temporary accommodation is embedded in this group. Second, and in contrast, residential housing which corresponds to a more pleasurable use of space at home. Debating temporary shelter arrangement is a common condition for the increasing poor households in the U.S. homeless and doubled-up households. Those who live on the streets, in massive city shelter, in single rooms in transit welfare hotels; 'the meaning of home' concerns some of very basic elements of shelter. For these people an ideal home is defined as a place to which bring friends and relatives, as a refuge, as a safe environment, as an enough space of rooms for their daily need.

As Elizabeth Huttman, in this book in her paper *"The Homeless and Doubled-up Households"* asserts homeless families have lost the normal meaning of home, constructing a shelter will help them realize a place to belong, a place for privacy, a place for develop and grow, and a place that is comfortable. For these people home is an essential ingredient that will give them life structure and meaning. Thus, to equip homeless individuals and families with adequate and safe housing it is imperative to turn our focus to experimental consequences of the previous

constructing; providing a home, which complies with the expectations of the occupants and friendly with the environment. For this type of housing, home is consequently subjected to other values and use of patterns.

Chan W.R., (2006) declares a new type of Emergency Sheltering in this paper. One catastrophic event that might threaten the public health is the exposure to the chemical releases especially for the zones and communities close to the nuclear activities, there is always an overwhelming concern towards the future disasters. The policy considered for the areas prone to hazardous toxic chemical releases, unexpected release of the chemical materials make experts inevitable to think over a solution to act swiftly. In this condition, when there is the less time for evacuation of the place the most logical alternative is to harbor the existent residents in their recently resided place.

Amos Rapoport, (1969) describes the symbolic use of space within the built environment, and the role of the house as not only a shelter, but also in shaping and reflecting the dynamics of a particular society. In many traditional societies, the domestic house is the most important among three-dimensional structures. More than just a shelter, the house represents a piece of ordered space where contextual clues explain and define the rules of behavior within the built environment.

Rathi, V., (2010), specifically looks at the emergency shelter needs of a developed country and the shelter type is transitional which is defined as a shelter where victims live at least for a year or more. The study covers a broad survey of all the different kinds of emergency shelters available and the ones that had been used in the past based on the kind of material used, structure, cost, and durability, ease of construction, size and transportability.

Sloan' thesis (2009) is an architectural exploration into how to partially address the housing crisis affecting the visibly homeless population of Charleston, South Carolina. Thousands of men, women, and children in the United States are homeless in Charleston where there is a significant and increasing number of visibly homeless. Shelter as a necessity rather than as a negotiated commodity is the reality of a homeless person. Shelter that strives to satisfy basic physiological, social, safety, and self-esteem needs and utilizes affordable construction strategies can best support the visibly homeless in Charleston.

Senkosi Balyejjusa, M., (2009) refers to asylum seekers from shelters. The research question guiding the study is as follows: how do emergency and temporary shelter services contribute to the successful settlement of female asylum seekers in Montreal.

Unlike refugees selected from abroad and landed migrants whose travel is planned and coordinated, asylum seekers arrive without any prior preparation (Godin & Renaud, 2002; Renaud et al. 2003). Shelters should provide a range of services to meet the needs of asylum seekers such as temporary emergency accommodation, food, clothing, information about the new environment and resources within the community, and linking them to other agencies, which provide services to vulnerable people (Access Alliance, 2003; Godin & Renaud, 2002; Lim et al. 2005).

Siavash Sefidgar Zanjani, (2008-2009) indicates transitional shelters. The main aim of the article is to refresh the nature and architectural contact by considering the traditional architecture in ancient China. In this regard, there will be a sense of belonging to the environment and the dwelling. Thus, allowing homeless people to help preparing shelters will lead to create a stronger society bond and a sense of livelihood to the family and the community.

This thesis investigates the architecture of transitional housing in regions recovering from natural disasters as 'hybrid' architecture; a type of architecture that is neither permanent nor temporary; rather, it is permanent and temporary. Using the 'Great Sichuan Earthquake' in China happening on May 12, 2008 in the Sichuan Province as a study model, the construction of the proposed transitional homes will address the concept of 'hybridity' by working with both transitional methods and ideologies, as well as implementing new disaster relief strategies. The thesis follows the procedure of the research by investigating strategies of temporary houses in some countries like Turkey, Japan, India and Peru and comparing them with the method of building traditional housing in China.

In this respect, the paper also focuses on the literature of a shelter, which can be attached to the natural environment conveniently. Although a temporary shelter should be economical but there must be a consideration to the human well-being and comfort as well. This strategy uses cultural and philosophical assets that were

inherited by the Chinese people throughout the centuries in order to create an environment that generates a sense of belonging, in other words, an absolute “home”.

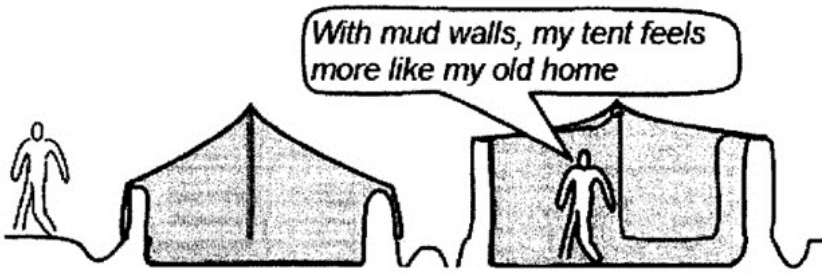


Figure 2.1 : Modifying the emergency shelters to a more permanent house (Siavash Sefidgar Zanjani, 2008-2009).

Charla J. Mitchell Stein, (1999), emphasizes depression of homeless who live in temporary shelter. The purpose of the study is to compare the depression levels of adolescents in an emergency shelter versus staying in a temporary housing facility. According to the null hypothesis of this paper, homeless adolescents living with their families in an emergency housing shelter will not differ significantly from those living with their families in temporary housing shelter in terms of depression controlling for families interaction. The effect of homelessness on the emotional well-being of adolescents living in temporary housing shelters and in emergency shelters has received only cursory attention in the literature of child development and family relations. Family interactions of homeless adolescents living with their family in an emergency shelter or temporary shelter have not been researched.

According to (Cassidy Johnson. 2007), emergency housing can be reusable. Under several conditions the shelters with the purpose of interim use can be used later. Providing sustainable temporary housing depends on their durability to be reused in the second life. Temporary housing is mostly built in the times of emergency need of sheltering for the purpose of recovery and preventing the problems happening in virtue of homelessness.

Units in good conditions, after being built can be used later by other affected families years or months later.

Overall, large investments in temporary housing make it very expensive in relation to its lifespan. There is generally a scarcity of building resources in developing countries. In Turkey after the 1999 earthquakes show that there are several patterns

of outcomes for temporary housing projects, i.e., rental housing, refurbishment/storage, recycling whole/part into new buildings/uses. The research reveals living patterns and design considerations for reuse of temporary housing, which can be integrated into strategic planning for temporary housing.

2.2 How Will My Thesis Contribute to the Literature on Emergency Housing?

The whole thesis represents the problems and recommended solutions, which show up in sheltering and housing stem. These problems are often investigated in case studies. Compounding the entire transcripts over Emergency Housing and its causes in the variety of case studies illustrated in the projects will lead us to achieve a more reliable scheme for Emergency Housing. This scheme will be deemed by declaring general and mutual patterns by analyzing the whole projects experienced recently. As seen the majority of the researches are allotted to the management and recovery phase of sheltering further than its design. In Stinson's view, there are countable individual causes leading to increase of homelessness. As McCrary Quincy cites in his survey in Lawrence, a perfect shelter system for homeless is more accepted when it is with public participation that can promote their self-esteem. ***Self-help*** is a method for promoting responsibility and pleasure among the victims and reducing constructing time and money that can be considered as a main key for shelter constructing. FEMA's failure as Frimpong asserts magnifies the importance of revising temporary housing in the view of ***Durability***, which is an evaluation factor in this research. Sense of belonging and ***Environmental Friendly*** shelters are alternatives of more importance to fulfill Users' Expectations as Arias declares. ***Time*** is another significant factor addressed by Chan in the time of emergency response especially when the condition is so critical this emergency must firstly go to the most vulnerable community like old people, women and children according to Balyejjusa and Mitchell Stein. Rapoport accentuates the role of ***Use of Space*** in declaring one's behavior within that built environment. Johnson and Zanjani also emphasizes for a more adaptive and ***Sustainable*** shelter that can be used later, whereas Rathi mostly and Sloan consider Economy as the most important element in responding emergency.

Item of time of response besides self-help, durability, sustainability, sense of belonging and ecological impacts of shelters as the quality factors are the aspects effective in emergency housing evaluation used in this dissertation.

3. TERMINOLOGY

3.1 Emergency Housing

Typically, Emergency housing is described as short-term supportive accommodation for those in calamity condition without a home looking for a shelter to survive and recover. Emergency Housing is designed to assist individuals and families that are homeless through a temporary, emergency situation. An emergency housing is equipped with necessities, such as a place to sleep, shower, do laundry, get clothing, and eat or get money for food. Usually these facilities restricted to men, women, youth or other groups with specific needs, such as victims of abuse, and individuals sleeping "on the street", evicted from home and need a place to stay while they look for a new permanent place to live, those in danger of being hurt if they stay in their home. This assistance commences when the government announces the condition urgent due to the scope of the crisis and poses individuals and families who lose their shelters.

In this perspective, shelters and hostels are two common examples of emergency housing. There may also be smaller religious or community-based organizations that provide emergency housing, i.e. for over a century; the Salvation Army Emergency Shelter, which was based on the church laws, has helped tens of thousands of homeless and poor people from Lawrence and the local communities (Quincy Dalton McCrary, 2008). The mission of The Salvation Army is to bring the whole world under the authority and rule of Jesus Christ.

In this respect, Emergency Housing is different from long-term supportive housing, which serves those who suffer from chronic homelessness. Those supported by emergency housing include victims of domestic violence and other hardships.

3.2 Etymology of the Term “Shelter”

- Shelter (English): 1585, 1. "structure affording protection”, 2. "roof or wall formed by locked shields,"

- Umbraculum (Latin): shelter, shade; protection from sun.
- Barınacak (Turkish): shelter or refuge, accommodation.
- Abri (French): a place where one is sheltered from the elements or harm.
- سرپناه (sarpanâh), (Persian): a place for refugees

3.3 Related Concepts

Although the definition of housing and sheltering seems self-explanatory, they are frequently mistaken for one another and used interchangeably. According to the uses that were made, the words sometimes deformed or reduced their significance. Based on this, this part has been dedicated to clarify the blurring definition of the terms housing and sheltering and gives a broad explanation of the distinct differences among the shelters.

In the beginning, the context explains the term shelter and the issues indicating the difference between housing and sheltering. In this section, the survey subsequently familiarizes the reader with the various types of sheltering and then declares the differences among the definitions. The section is then accompanied with the terms that need to be expanded more in meaning like disaster, homeless, homelessness and refugee.

3.3.1 Adequate shelter

"Adequate shelter means more than a roof over one's head. It also means adequate privacy; adequate space; physical accessibility; adequate security; security of tenure; structural stability and durability; adequate lighting, heating and ventilation; adequate basic infrastructure, such as water-supply, sanitation and waste-management facilities; suitable environmental quality and health-related factors; and adequate and accessible location with regard to work and basic facilities: all of which should be available at an affordable cost." (Para. 60 of the Habitat Agenda).

3.3.2 Sheltering and housing

Housing in contrast to sheltering whether of a temporary or permanent nature is a source of widespread and often intense complaints (Davis, 1978). The lack of attention to meet people's demands and expectations provokes the complaints.

The term shelter has been used to refer to everything from an evacuee leaving home to stay in a neighbor's house for a few hours while awaiting the passing of a dangerous threat. Shelter is also allotted to a longer use (several years) to an evacuee staying with relatives for in a different part of the country while waiting for the rebuilding of a house in the local community. The term shelter also has, on one hand, had reference to solo behavior by an individual, and on the other hand, to multi-person and group activities involved in mass sheltering of many evacuees in public facilities. The term housing as used in the literature has suffered equally from similar problems. It sometimes refers to an evacuee's returning to one's original home; at other times, it is to the obtaining of new quarters in a different locality by displaced households (E.L. Quarantelli, 1995).

3.3.3 Shelter categories

Considering different shelters, in recovery stage, shelters can be categorized sheltering into four groups: Emergency Sheltering, Spontaneous Shelter; Temporary, transitional or semi-permanent Housing; Temporary Housing that can be converted to Permanent Housing and Permanent Housing.

Shelter is a broad concept with many different interpretations. This study focuses on a specific type of shelter, which is emergency shelter and temporary shelter. Emergency shelters are used in situations where populations are forced to leave their home and suddenly become homeless, situations that often arise in areas affected by earthquakes, floods or civil war. For longer iterim stay, temporary housing is suggested.

3.3.3.1 Emergency sheltering, spontaneous shelter

The emergency shelter is the first emergency shelter that is used after the onset of a disaster or conflict has struck as the house may be permanently damaged or maybe because the utilities for the town are not functioning at that time. This provides shelter refugees in their urgent need for shelter. The emergency shelter is often easy to transport and to build up quickly, so that in the event of an emergency a rapid response can be put in motion. The living conditions are often far from ideal and the shelter has a very limited life. This refers to a shelter that a disaster victim seeks

immediately after the disaster generally is considered to be utilized in the first three days, to make provisory, safe place meanwhile the situation soothes.

3.3.3.2 Temporary housing, interim housing, transitional shelters

*A word about terminolog*y: temporary, interim, transitional and semi-permanent are common descriptors. In this project, the word temporary will be used to highlight the physical pattern. Temporary Housing has been regarded to be utilized for a year to ten years, and defined as a place where families can reestablish household responsibilities and daily activities for an interim period shelter which is provided with water, power, and heating until a permanent housing solution can be found.

According to Andrew Maskrey, temporary housing is a gap between the infant of calamity and reconstruction. Temporary Housing is return to normal daily activities in a temporary location (as per Quarantelli, 1995)

Temporary housing has occurred after most recent large-scale disasters and the type of temporary housing varies from very basic shacks or distributed materials placed alongside the damaged properties, to the construction of temporary 'suburban' settlements including all the necessary amenities and infrastructure (Cassidy Johnson, 1999). The temporary shelter is sometimes called semi-permanent because it is wholly or partially dismantled and the materials can be reused in another application.

Diagnosis of the temporary housing

Temporary housing has traditionally been addressed in one of two ways: by providing households with allowances for prolonged hotel stays (with imposed limits) and/or by providing trailers and even entire mobile-home parks. Each of these solutions suffers from drawbacks: hotel stays can become very expensive and not intended to be real homes. Trailers leave disaster victims in harm's way for later weather events such as the next hurricane season, and their acquisition can create shortages and drive up prices outside the disaster area. A significant number of impacted victims also find housing with families and friends as an informal response to their displacement (Agyemang Frimpong, 2010).

3.3.3.3 Temporary housing that can be converted to permanent housing

There is a gray area between permanent and temporary housing, often called something as transitional shelter, while the ultimate life is far above a 10-year. It mostly happens when the residents of the temporary shelter are satisfied with their accommodations and do not want to work on a more sustainable solution and has the opportunity to change and improve shelter condition.

3.3.3.4 Permanent housing

It is aimed to provide long-term, permanent housing solutions for disaster victims (HRWG, 1998). The permanent shelter is a shelter with an intended life of more than 10 years. This form of shelters is a sustainable solution to resume refugees to their normal lives. Permanent shelter is characterized by the use of sustainable materials that are often not dismantled after construction of the shelter.

Regarding the standard of the construction the time spent to build a permanent housing last long that leaves the victims inevitable of living in temporary housing more that the time that has been estimated. Example of it is the experience in the New Orleans' Hurricane Katrina in 2005 that after four years people were still living in an unsafe condition in the temporary housing still waiting for a permanent accommodation to be constructed.

3.4 Assessment to Shelter Categories

3.4.1 An assessment to temporary and emergency sheltering

Obviously, emergency and temporary sheltering shades into one another, but there are differences in the behavioral aspects that are worth distinguishing for practical as well as theoretical purposes. For example, emergency sheltering does not usually raise the question of where and how the displaced disaster victims will be fed, but temporary sheltering does (E.L. Quarantelli, 1995).

Temporary housing provides homeless people with an immediate, stable, and private environment that fills the gap between emergency shelters and permanent shelters. Social services and financial counseling are often available. The purpose of temporary shelter is to keep the individuals off the street, help the adults and children

emotionally with counseling, financial planning, savings strategies, and when necessary, retaining them in job skills with the ultimate goal of self-sufficiency. It is also referred to as “transitional housing” (Rivlin & Imbimbo, 1989).

On the contrary, an emergency shelter is an on-site facility with limited sleeping capacity. The shelter allows the client a limited number of nights and includes communal meal, shared bathroom facilities, and group-centered activities. Privacy is difficult, if not possible, to achieve with specific rules regarding lights out and early morning departure (Huttman & Redmond, 1992).

Finally, the transitional shelters seem more at home than a traditional emergency shelters. The materials are much more durable and the buildings are often partially founded.

3.4.2 An assessment to temporary and permanent housing

Unlike the shading between emergency and temporary sheltering, there is usually a sharp distinction between temporary and permanent housing. The exception occurs when what is defined initially as temporary housing actually becomes the permanent homes of the victims (E.L. Quarantelli, 1995).

Temporary housing could only be provided after emergency management agencies and other response organizations have made damage assessments. This type of housing does not have a solid foundation and can easily be removed (Waugh, 2000). Permanent housing is the final phase of housing reconstruction and household recovery and this is the provision of prominent housing when families do not face further moves (Waugh and Tierney, 2007).

3.5 Disaster

The notion of a disaster has undergone a dramatic transformation of meaning.

According to Drabek (1991), in the past, many, if not most, cultures around the world viewed disasters as acts of God. The injury, death, destruction, and disruption associated with catastrophic events were often regarded to be punishments that fulfilled the divine, and sometimes unknown, purposes of a supernatural being (Steinberg, 1985).

Any community could be struck by a disaster at any time. “A disaster can be defined as an event that involves the occurrence or imminent threat of widespread or severe damage, injury, or loss of life and property resulting from any natural, manmade or hybrid causes including but not limited to, fire, flood, earthquake, hurricane, tornado, high water, landslide, mudslide, windstorm, wave action, volcanic activity, epidemic, and bridge collapse” (Waugh and Tierney, 2007 p 144). Disasters occur when hazards have not been adequately managed, but they may also occur with little or no warning and without apparent reason (Milleti, 1999). Natural disasters can happen at any time and place. Natural disaster does not selectively strike particular communities or group of people; however, some places are more vulnerable and certain segments of the population are predisposed to disasters, e.g., the poor tend to line at the lower levels of flood zones (Platt, 1999; Squires and Hartman, 2006).

Recovery includes post disaster activities designed to restore basic services, such as repairing lifelines such as power and water (Waugh, 2000). It also includes Temporary Housing, food and clothing, debris clearance, psychological counseling, job assistance and loans to restart small businesses.

The Center for Research on the Epidemiology of Disasters (CRED) requires that for a disaster to be entered into the database at least one of the following criteria has to be fulfilled:

- Ten or more people reported killed

- 100 people reported affected

- A call for international assistance; and

- Declaration of a state of emergency, (Ibrahim Mohammad Shaluf, 2007).

3.6 Homeless

The term “homeless” or “homeless individual or homeless person” includes – (1) an individual who lacks a fixed, regular, and adequate nighttime residence; and (2) an individual who has a primary nighttime residence that is – (A) a supervised publicly or privately operated shelter designed to provide temporary living accommodations (including welfare hotels, congregate shelters, and transitional housing for the mentally ill); (B) an institution that provides a temporary residence for individuals

intended to be institutionalized; or (C) a public or private place not designed for, or ordinarily used as, a regular sleeping accommodation for human beings (Legal Information Institute, 2005).

The United States legal definition of homelessness serves as the operational definition of homelessness for this dissertation. The legal definition of homeless is summarized as a person who lacks a fixed, regular, and adequate nighttime residence and can include people who live in temporary accommodations, such as shelters, and people who live in public places, such as the outdoors (Legal Information Institute, 2005).

Homeless people are constructed as part of a lazy, irresponsible, addicted, or criminal underclass" (Williams 2003: 176).

Primarily emergency housing is used for the indispensable need of sheltering for the purpose of recovery and cope with the subsequent problems of homelessness. Once the human being becomes homeless, for the sake of survival, seeks for a shelter to settle in. In this condition finding a temporary shelter as a basic need is the first step of recovering.

3.7 Slum and Squatter Settlements

Today, informal urban settlements are marginal groups who are not attached by the body of the city and are forced to find a shelter in some regions of the city. The regions are often away from the care of the residents and city officials and poor reside in the regions that are not essentially located in the urban fringe.

The population in the fringe houses of the cities, are tin-made rooms, sheds, tents, gamier(dereliction), groin (houses whose walls are made from building materials but the roofs are from mat and the leaves of the trees) and ruined rooms. Therefore, in fringes, most of the residential units are built from the weak and preliminary materials in an unstable and non-technical way that make the marginal people much more vulnerable facing hazards compared with people living in urban areas. Lack of standards of life and possible catastrophes on the other hand always threaten their lives.

Chaotic and unorganized nature of the squatters with unstable and poor quality of materials has distressed experts of the future adverse incident that will subject to

massive loss, which necessitates should be preceded to help victims. Shelter in this regard plays a very crucial role to relieve the condition.

Current practices in disaster housing vary based on the nature and scope of a disaster and can range from providing short-term shelters to arranging temporary and in some cases, permanent housing (Agyemang Frimpong, 2010).

3.8 Refugee

"The United Nations High Commission for Refugees [UNHCR] (2007a) maintains that a person is considered a refugee when they are applying for refugee status from outside of the host country and when the following conditions apply: As a result of events occurring before 1 January 1952 and owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable, or owing to such fear is unwilling to avail himself of the protection of that country; or who, not having nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it". (Moses Senkosi Balyejjusa, 2009, p.16).

4. EMERGENCY HOUSING CATEGORIES

Examples concerning emergency housing, assembled from commonly used shelters, the most recently implemented shelters, those that have won prizes in competitions and innovative backgrounds have been embedded in this chapter. Subsequently, each case will be indwelled in the category of emergency housing (emergency shelter, temporary shelter, temporary that can be converted to permanent shelter and permanent shelter). In each category, the examples representing the same concept will be classified in one group. The selected alternatives of every category will be each presented in terms of definition, deploying and construction method and specifications separately. A probable case study would be added to per sample to aid for a better understanding of the survey. In chapter 5, the assessment of each category will lead us to find out the better example of emergency housing in a specific condition. The assessment will be according to the items of time and quality (architectural aspects, environmental performance and comfort). The assessment have been set to define how much a shelter design has cared about the users' universal requirements and which one has been more successful to extract the effective patterns.

4.1 Emergency Shelter

4.1.1 Tents and paper shelters

This part encompasses tents (UNHCR tunnel tent - light emergency tent weight (LWET), light weight emergency shelter, shelter frame kit, 139 shelter) and paper shelters (paper tube emergency shelter, paper partition system).

Tents are portable shelters with a cover and a structure. In other words:

Tent = cover + structure

Emergency Shelter tents: "As accepted to be erected immediately after the crisis occurrence. The life span of an erected tent depends on the climate and the care

given by its occupants; it may be as long as 2 to 3 years" (United Nation Publication, 2004).

In this part of the thesis, *More Recent and Developed Applicable Tents* will be introduced and in the next chapter, they will be assessed. Broadly spoken, tents are not suitable as cold climate shelters, but if there is no choice, they can save lives and bridge the time until more suitable shelters are established. Below in the figure 4.1 the components of a typical tent are drawn.

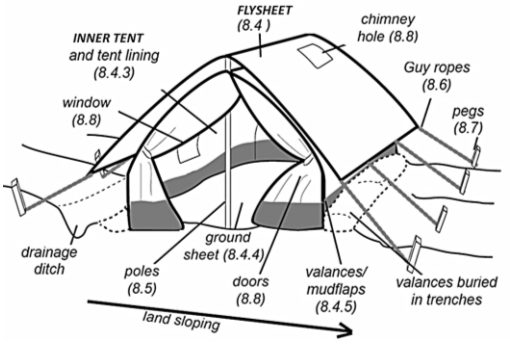


Figure 4.1 : Standards and specifications of tents for use today (UN Publication, 2004).

According to various demands different forms of tents has come to earth (See figure 4.2).

Figure 4.2 : A comparison of the tents which are available (Karin Freij, 2008).

Mutual Concept of Tents and Paper Shelters: To provide a fast deployable – transportable shelter that uses the minimum energy.

4.1.1.1 UNHCR tunnel tent - light weight emergency tent (LWET)

An introduction to this type of shelter is identified in three steps: Definition, Specification and Case study:

- Definition: In Chad, in response to the Darfur crisis, Ghassem Fardanesh accompanied with UNHCR and designed an innovative new tent called "Lightweight Emergency Tent" for easy transportation to any disastrous zones. It was a blessing for both the refugees and the UNHCR. LWET Excelled canvas tents in lightweight, durability, longer shelf life and low cost (See the figure 4.3).

Figure 4.3 : Conceptual design and built prototype of LWET(http://pakbusiness.com .pk/general-trade/ and http://www.keepshooting.com/un-lightweight-emergency-tent.html and UN Refugee agency (UNHCR), 2006).

- Specifications:

A. *Shelter Function:* Emergency Shelter

B. *Users:* Natural Disastrous Victims and War-Torn Victims

C. *Climate:* Used in whole types of weather

D. *Structural Components:*

Envelope – The two windows are equipped with two canopies.

Entrance – A rolling canopy for the 2 front doors is devised more identified entrance.

Material – Made of breathable materials: Outer Tent: Made of woven rips, Polyester cloth, Inner Tent: Poly Cotton Cloth, Ground Sheet: HDPE

- Case study: DILI, Timor- Leste, refugees of war – 2006: UNHCR's Lightweight Emergency Tent Implementation for the *Refugees* who were forced from their homes by armed conflict in DILI.

In late April 2006, thousands of refugees fled their homes in Dili after a protest by 600 sacked soldiers turned violent, which led to widespread burning, looting and destruction of property and injury of people. Through implementing partners, UNHCR has distributed 2,300 tents for 30,000 internally displaced persons (IDP) in DILI and surrounding districts (see figure 4.4 a & figure 4.4 b).

Figure 4.4 : (a) The location of Timpor-Leste, (b) The first UNHCR tent goes up at DILI's Comoro airport (http://www.unhcr.org/cgi- bin/texis/vtx/news/).

4.1.1.2 Light weight emergency shelter

An introduction to this type of shelter is identified in three steps: Definition, Specification and Construction method:

- Definition: It won first place in nonprofit Design 21‘s ‘Shelter Me’ competition in 2007, designed by Patrick Warram a tent is a typical “home” for campers, it’s also a proven emergency shelter.
- Specifications:

A. *Shelter Function:* Emergency Shelter
B. *Users:* Natural Disastrous Victims
C. *Climate:* It is not much stable in critic weather.
D. *Structural Components:*

Envelope – Double Fold doors and Windows equipped with canopies.

Material – Recycled polyester mesh aluminum –The materials have the capability to get unfolded and create a rigid form

- Construction method: The deployment instruction and Prototype models are shown in figure 4.5.

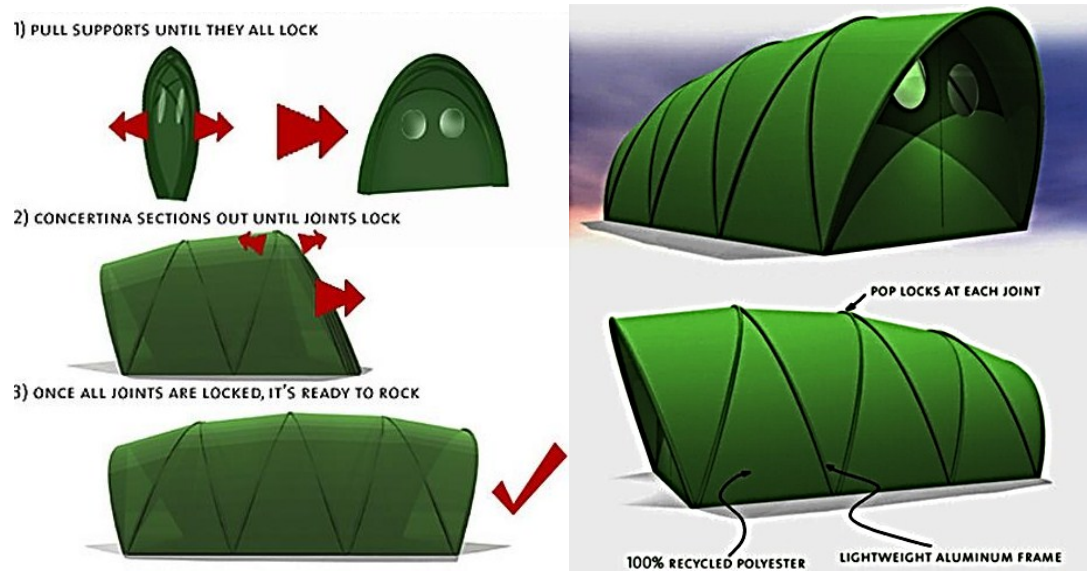


Figure 4.5 : Conceptual design and built prototype of Lightweight Emergency Shelter (http://gliving.com/lightweight-emergency-shelter-no-dreaded-ikea-moments/).

4.1.1.3 Shelter frame kit, shelter systems' emergency disaster relief yurt and dome tents

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: Shelter Systems has provided shelters worldwide for over 30 years. These shelters are durable, portable and affordable. They come in a range of sizes from 14 foot to 30 feet in diameter. They are intended to "turn sheeting into shelter" (Thames & Hudson, Design Like You Give a Damn, 2006).
- Specifications:

A. *Shelter Function:* Emergency Shelter
B. *Users:* Natural Disastrous Victims
C. *Climate:* Dry and Hot

They are normally designed for warm weather. In a snowy climate, one should use a propane heater, an electric radiator heater, or a wood stove to heat your dome. The tent is vulnerable to extra loads. In a snowy weather, it is necessary to knock off the snow periodically.

D. Structural *Components:*

Envelope – The roof is slope to reduce snow load.

Entrance – The doors are equipped with canopies to create a shaded pleasant zone in the entrance. It can be rolled up when not needed.

Material – OFDA plastic sheeting , PVC frame.

- Construction method: The Shelter First sets up easily and quickly by one person. At the beginning, the covering is staked out. Then you climb under the covering and insert the five vertical poles into the factory attached Pole Clips ™.
- Case study: shelter system's 18' relief dome tents in Venezuela: In Venezuela, the government had to provide shelter for up to almost 10,000 people left homeless by the recent floods (see figure 4.6).

Figure 4.6 : Shelters accommodating people of Haiti (http://www.shelter- systems. com/).

4.1.1.4 139 shelter

An introduction to this type of shelter is identified in three steps: Definition, Specification, and Case study:

- Definition: A Portable-folded shelter designed by 'Future Systems' in 1989, collapses for easy transport and opens with the turn of winch.
- Specifications:

A. *Shelter Function:* Emergency Shelter

B. *Users:* Migrants and refugees

C. *Climate:* Hot and Dry

- Case study: Ethiopia: Architecture for Humanity developed a project for Oxfam for refugees in Ethiopia, a deployable structure that works similarly to an umbrella. This project however was never realized because of cost ($30,000 per unit) and the reliance on trucks, aircraft, or other large vehicles, as well as skilled workers to assemble the project (see figure 4.7).

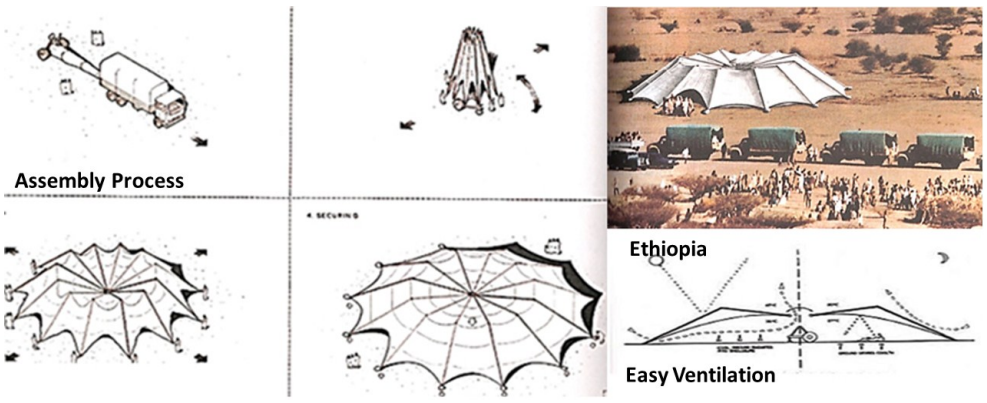


Figure 4.7 : Conceptual design and built prototype of 139 shelter (http://agnesglaz. blogspot.com/ & http://1.bp.blogspot.com/).

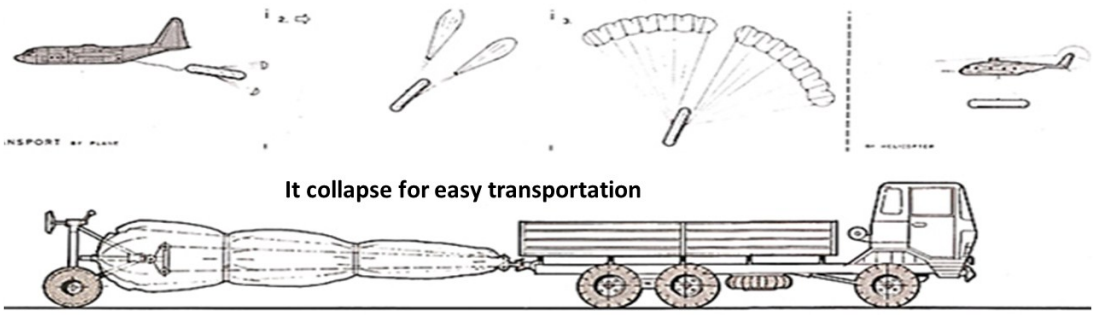


Figure 4.7 (continued) : Conceptual design and built prototype of 139 shelter (http ://agnesglaz. blogspot.com/ & http://1 .bp .blogspot. com/).

4.1.1.5 Paper tube emergency shelter

An introduction to this type of shelter is identified in two steps: Definition and Case study:

- Definition: In 1994 Rwanda's civil War displaced more than 2 million people; The paper tube, an industrial "waste" used by Shigeru Ban in his projects, 50 US dollars per unit, when the United Nations High Commissioner for Refugees asked him to provide a design for cheap temporary sheltering for the victims of the civil war in Rwanda's.
- Case study: Haiti: For Africa, Haiti and Turkey, Ban applied a design, developed in 2005, consisting of a system of columns and beams made with paper tubes, wooden joints and paper rolls that can be unrolled whenever the families need more intimacy. This simple structure can be easily assembled in one hour (URL-5). In figue 4.8 a and 4.8 b, the examples of primitive paper shelters are shown.

Figure 4.8: left to right- (a) Paper Emergency Shelters for the UNHCR, Yumba Refugee Camp, Rwanda, 1999. (b) Haiti - Port-au-Prince, Haiti, 2010 (http://flaunt.com/blogs/intern/shigeru-ban).

4.1.1.6 Paper partition system

An introduction to this type of shelter is identified in four steps: Definition and Specification, Updradig process and Case study:

- Definition: The first Paper Partition System (PPS1) is a fast deployable shelter that was created for the refugees of the Niigata Earthquake in 2004 and this time the system became the 4th generation. All the structures are made of paper tubes without any plywood pieces for joints or ropes for braces, which have been developed for fast and easy assembly.
- Specifications:

A. *Shelter Function:* Emergency Shelter

B. *Users:* Natural Disastrous Victims and War-Torn Victims

C. *Climate:* Used in various climates

D. Structural Components:

Material – Column, Beam, Joints: Paper Tube | Curtain: White Canvas | Others: Pins, Clips

- Upgrading process: (PPS1) Paper partition system was first implemented in 2004 after an earthquake in Niigata, Japan. Utilizing white cloth for partitions, joints were made of plywood, and ropes were used for braces. Simple laminated cardboard sheets were offered for insulation and to create a border between families who craved privacy from their neighbors. (PPS1) Initially the cardboard was only used to cover the floor, however after the number of evacuees decreased; the cardboard was used to create partitions for nighttime privacy. Courtesy of Shigeru Ban Architects' dimensions were also standardized at 180cm, and because it is nearly impossible to forecast partition demand, low cost and high speed were the priorities in developing the partition system (URL-6).
- Case study: Architects response to 2011 great Tohoku earthquake and tsunami.

Figure 4.9 shows the upgrading process of paper shelters in Japan.

Figure 4.9 : Upgrading phases of paper partition system (http://www.tumblr.com/).

4.2 Temporary Housing

*"*These are 'transitional' as opposed to 'temporary'. Emergency shelter is temporary and is intended just to provide shelter for survival. Transitional implies something that is longer-term and gives you space to carry out livelihood activities rather than just surviving." (Elizabeth Babister, shelter advisor, Design like you give a damn, p 87).

4.2.1 Temporary housing - group 1

This part encompasses first step housing, soft house; global village shelter (GVS) and primitive emergency shelter, portable.

MUTUAL CONCEPT: To provide a transitional flexible shelter out of prefabricated structure for a maximum use of space.

4.2.1.1 First step housing, soft house – 2003

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: Stephanie Forsythe and Todd MacAllen of Vancouverv recently won the First Step Housing Competition for their design of the interior of a New York Bowery "flophouse" hotel. Along the walls of the hotel, they proposed building a set of shelves, a desk and lockable cabinets for each resident. "Tissue-blanket" movable walls surround this home base. Walls and ceilings can be folded tightly against the wall when the space is to be used for shared activities. When tenants desire solitude, the walls and ceilings can be pulled out for both visual and acoustic privacy. The designers are in dialogue with American suppliers about developing fireproof, washable, and foldable tissue blankets for use in the project. They anticipate that there will be other potential applications of "Soft Housing". (Vancouver Sun, December 9, 2003).
- Specifications

A. *Shelter Function:* Temporary Shelter

B. *Users:* Homeless people

C. *Climate:* Depending on the type of outdoor shell

D. *Structural Components:*

Envelope – The doors unfold to meet the exterior wall and describe an area of 64 square feet.

Material – polyethylene fiber sheets (plastic pallets) as construction base and wooden structure on top.

- Construction method: Inside the box, exchangeable wooden wall panels are mounted into the frame construction. The flat panels can be folded into the room and be used as furniture**.**
- Case study: New York, USA homeless – 2003: In New York City alone there are over 36.000 homeless people seeking refuge in shelters each night (Design Like you Give a Damn, P 192). This design proposed a moveable partition and furniture system for transitional homeless shelters. The inspiration was the wood pallet, often recycled as building blocks by homeless individuals. Using environmentally sustainable materials, the system creates inexpensive, quickly assembled, minimal dwelling spaces within existing buildings. Natural day lighting, sound absorption, a lively color scheme, and easily personalized spaces were achieved. A conceptual design and flexible hallway is shown in figure 4.10 and 4.11.

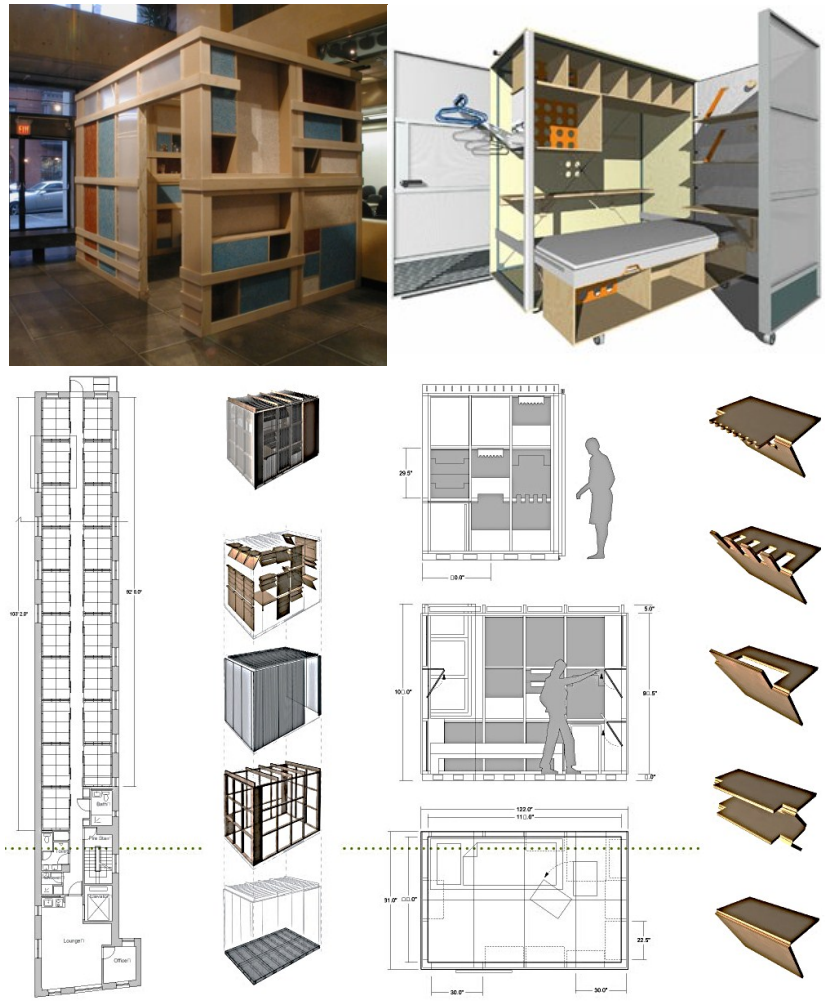


Figure 4.10 : Conceptual design and built prototype of Soft House (http: // architectstudent.net/projects/).

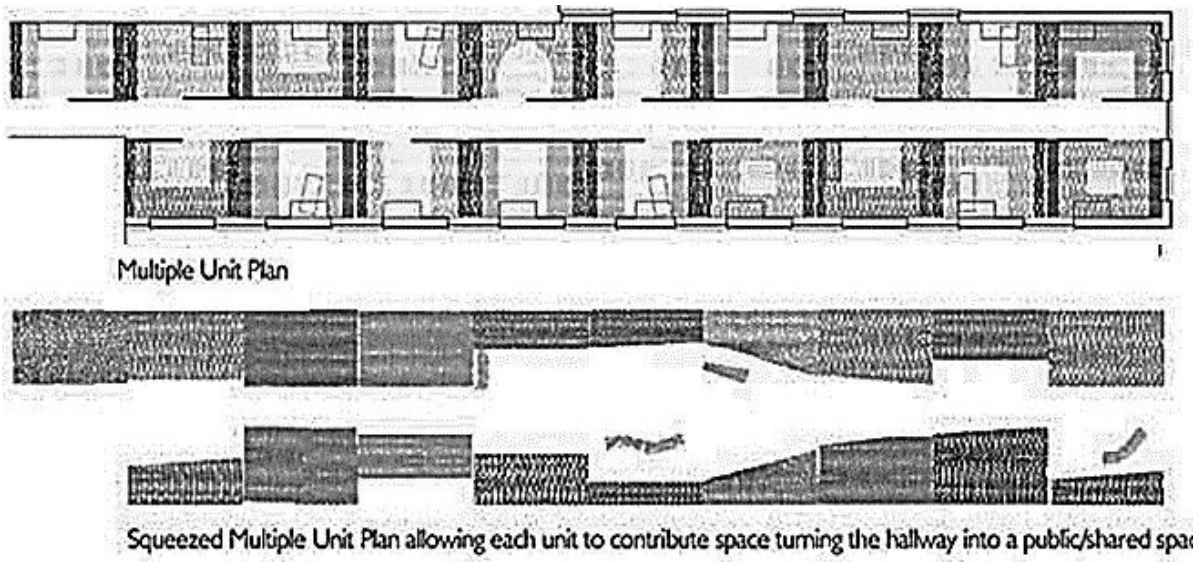


Figure 4.11 : Flexible hallway of Soft House (http://www.boehmarchitecture.com/).

4.2.1.2 Global village shelter (GVS) – 2005

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: It is biodegradable triple-wall corrugated house created for disaster victims by Ferra Design Inc., Grenada using cheaper, available and environment friendly materials. This project won first prize in a competition on the design for social change site Design21. A foldable, easy, fast solution for temporary housing made of laminated cardboard. Various attachment of the shelter is shown in figure 4.12.

Figure 4.12 : A typical GVS (http://catherinetoddarchitecture.blogspot.com/).

- Specifications**:**

A. *Shelter Function:* Temporary Shelter

B. *Users:* Natural Disastrous Victims

C. *Climate:* The problem is that the material cannot withstand bad weather.

D. *Structural Components:*

Envelope – A removable acrylic window with a screen and Dual locking door system

Material – Laminated cardboard, polyester mesh and aluminum

- Construction method: Step 1: Unfold base and expand. Step 2: Folding the roof beams into triangular shape. Step 3: Flip the two roof section and pull the extrusion using the pull rope. Step 4: Lift the assembled roof and put on the top of the base. Figure 4.13, indicates the instruction of deploying the foldable shelter.

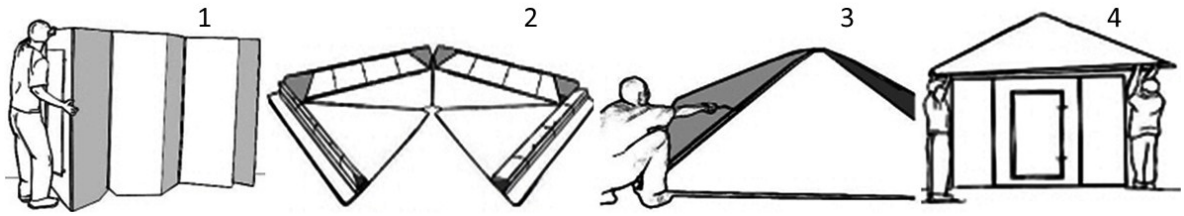


Figure 4.13 : The assembly instruction of GVS (http://4.bp.blogspot.com/).

- Case study: Grenada – 2004, Pakistan – 2005**:**

- In the reconstruction of Grenada following Hurricane Ivan in 2004 GVS have been used.
- They were also used in 2005 to house earthquake victims in Pakistan; shelters were used for both individual homes and small village settlements for orphans and widows.

4.2.1.3 Primitive emergency shelter, portable – 1940s

An introduction to this type of shelter is identified in two steps: Definition and Specification:

- Definition: *Alvar Aalto*[1] designed prefabricated houses made in response to the World War II housing crisis for displaced populations to provide interim housing out of traditional materials by the London Blitz in the early 1940s (URL-11).

[1] Aalto, who is also known for his furniture and glassware, worked in a unique style that blended modernism and traditional vernacular architecture. Retrieved from: http://www.modernconscience.com/store/page134.html

Because of the magnitude of the calamity, any camps were too transitory, or were self-settled and not 'designed'.

- Specifications:

A. *Shelter Function:* Temporary Shelter

B. *Users:* War-Torn Victims – World War II displaced population

C. *Climate:* In the whole types of weather

D. *Structural Components:*

Material – Vernacular covering + prefabricated structure. Below a prototype describing, the concept of the design is shown in figure 4.14.

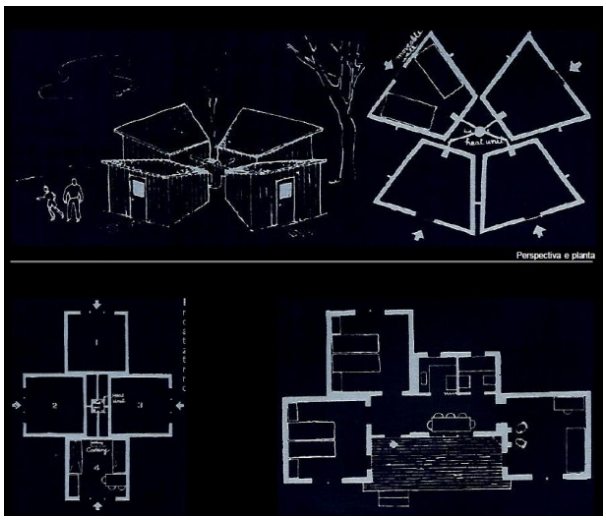


Figure 4.14 : Perspective and plan- Plan model for four families and arranging the modules for a single family plan in portable system(Arnfried Cardoso Ziebell, 2010).

4.2.2 Temporary housing - group 2

This part encompasses concrete canvas shelters (CCSs); next- gen dome, inter shelter domes, dome village and hexayurt.

MUTUAL CONCEPT: To Provide Affordable temporary housing with the benefits of permanent housing.

4.2.2.1 Concrete canvas shelters (CCSs) – 2012

An introduction to this type of shelter is identified in five steps: Definition, Specification, Construction method, Berming and Case study:

- Definition: A 25 square meter dome-shaped tent structure recently (2012) designed by Peter Brewin and William Crawford with use of concrete-infused fabric (URL-15). Essentially, CCSs are inflatable concrete buildings. Semi-Permanent Housing: CCS provides all the benefits of a permanent structure without the associated cost and time delays (URL-16). Prototype concept is shown in figure 4.15.

Figure 4.15 : Prototype built and concept of CCS (http://www.tinyhousedesign.com/wp-content/uploads/ & http://www.concretecanvas.co.uk).

- Specifications:

A. *Shelter Function:* Temporary Shelter
B. *Users:* Natural Disastrous Victims and Front line operation at wars
C. *Climate:* In the whole weather type
D. *Structural Components:*

Envelope – Openings can be engendered to allow the installation of services

Material – Concrete (a flexible cement impregnated fabric as structure)polyethylene (inside); Polycarbonate Translucent (ports); Earth (anchors).

- Construction method:

A. *Deliver:* CCS is supplied folded in polyethylene, airtight, water and rot proof sacks within ISPM15 heat-treated timber/ply panel crates.
B. *Inflate:* An electric fan is activated which inflates the plastic inner to lift the structure until it is self- supporting. The shelter is then pegged down with ground anchors around the base.
C. *Hydrate:* The CCS is then hydrated by spraying with water. Water does not need to be potable but must not be sewage. Seawater may be used.
D. *Set:* The Concrete Canvas cures in the shape of the inflated inner and 24 hours later the structure is ready to use. Access holes can be cut to allow the installation of services (see figure 4.16).

Figure 4.16 : Constructing Process of CCS (http://www.theworldsbestever.com /2010/01/20/concrete-canvas-shelters/).

- Berming:

Earth or snow berming is the practice of using earth or snow against building walls for external thermal mass, to reduce heat loss and to maintain a steady indoor air temperature. CCS structures have been modeled to withstand a very high distributed compressive load, enabling berming by sandbags, local fill material or snow. This gives the shelters excellent thermal properties and can provide protection against shrapnel, blasts and small arms fire (see figure 4.17).

Figure 4.17 : Showing Beriming Process of CCS (http://www.concretecanvas. co.uk /CCS_Earth_Berming.html).

- Case study: Haiti earthquake – 2012: Being perfect for Haiti earthquake victims in need of shelter, these Concrete Canvas Shelters "are rapidly deployable hardened shelters that require only water and air for construction.

4.2.2.2 Next- gen dome, inter shelter domes- dome village – 1993

An introduction to this type of shelter is identified in five steps: Definition, Specification, Case study I, Case study and Floor layout:

- Definition: Activist Ted Hayes founded the dome village in 1993 as an alternative for the many USA homeless people who are afraid of shelters. Therefore, the existing “Tent City” shantytown became Dome village. Inter Shelter is a lightweight safe and durable shelter that fills the gap between the tents and expensive trailers. Dome Village has created a positive and innovative approach to housing homeless people and achieves the goals of alleviating homelessness as it reduces urban blight and decay in city.
- Specifications:

A. *Shelter Function:* Temporary/Transitional Housing: Portable and mobile – move and transportable to anywhere.
B. *Users:* Natural Disastrous Victims, Homeless people and migrant workers,
C. *Climate:* Hot and Tropical, Dry and Desert Like

The gel used to coat the dome makes it considerably resilient to a multitude of climates. They are provided in 2 shapes that make it capable of being used in various climates:

One model is resistant to cold arctic type climate and the other is resilient to extreme desert climate.

D. *Structural Components:*

Material – Fiberglass-composite mixture and gel coated building

- Case study I: Los Angeles, California, USA- shantytowns homeless population – 1993: Several domes are linked together to form community space. The village itself acts as a microcosm of society, providing residents with a setting in which they may stabilize their lives and garner the skills necessary to reenter the "real world" (URL-13).

- Homeless Population: 82,096
- Cost per unit: $10.000
- Area: 314 sq. ft. / 29 sq. m
- Site: 1.3 acres/ .53 hectares
- 12 residential domes: couple/ family or divided
- 2 bathroom domes divided into eight bathrooms
- Outdoor seating & gardening areas (see figure 4.18)

Figure 4.18 : Dome Village, California, a smart solution for high-density housing (http://www .thefirstpoint.com/usa-dome-village-gal/).

- Case study II: Workers' shelter need in Alaska: This temporary building meets all OSHA and California building code requirements to provide washing facilities for 100 workers, to provide six workers private sleeping rooms, requirements to provide toilet facilities for 250 workers.

- Floor layout

- 2 Person Layout (figure 4.19 a)
- 4 Person Layout (figure 4.19 b)
- 6 Person Layout (figure 4.19 b)

- Dome Elevation (figure 4.19 c)
- Cluster Layout (figure 4.19 d)

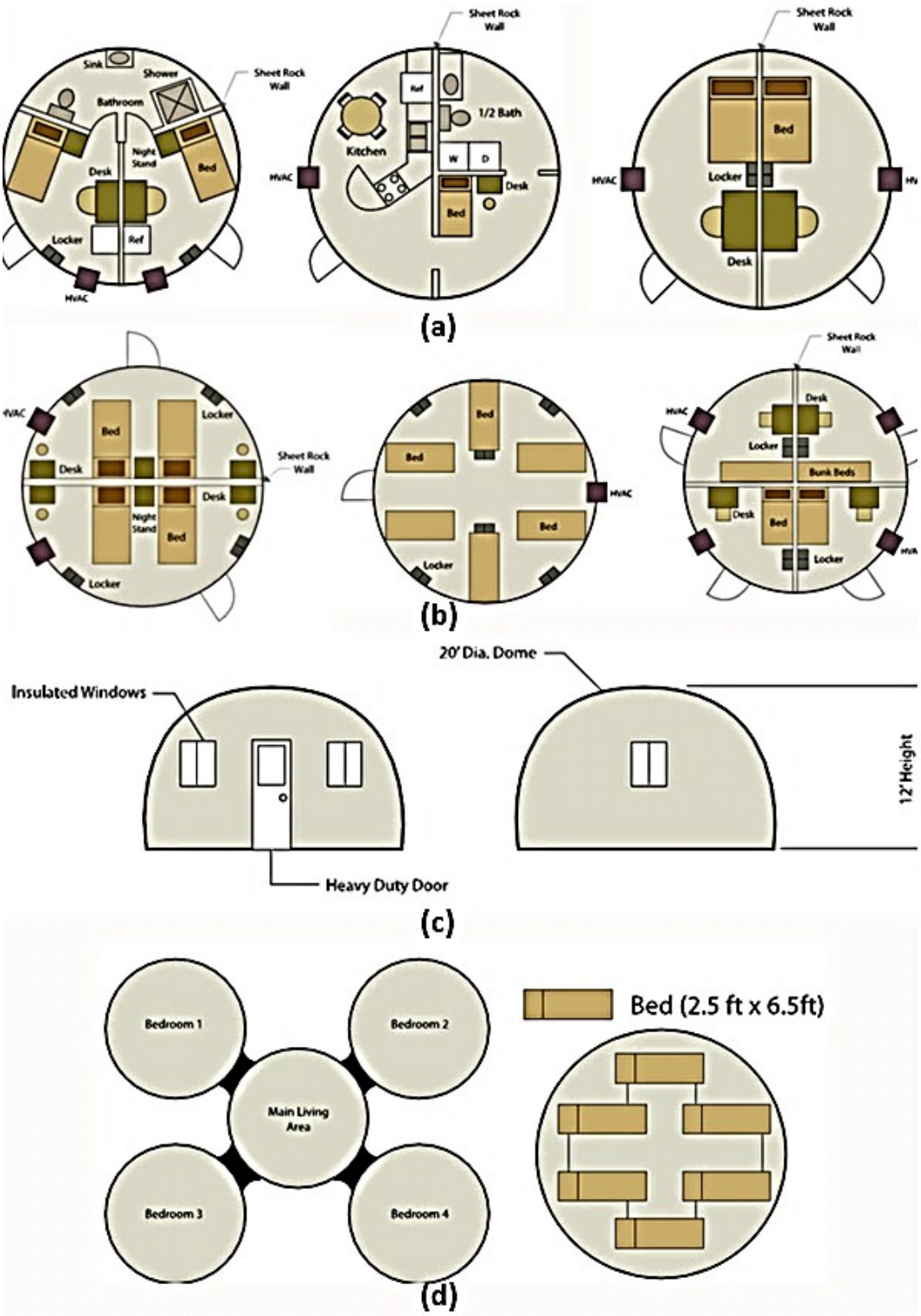


Figure 4.19 : Floor layout of dome village: (a) 2-person layout plan of dome village, (b) 4-person layout – 6-person layout plan of dome village, (c) Elevation of dome village, (d) Cluster Layout of dome village, (http://www.intershelter.com /uses).

4.2.2.3 Hexayurt – 2003

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: Designer Vinay Gupta has completed Hexayurt prototype at the Burning Man festival in 2003 for refugees and other people with a small housing budget. “Hexayurts are more like houses than tents and can come with an infrastructure package” (URL-14).
- Specifications:

A. *Shelter Function:* Temporary Shelter
B. *Users:* homeless people, Migrants, and refugees
C. *Climate:* Depending on the used materials, the shelter can endure in various climate conditions. This shelter can withstand in a tropical savanna climate.
D. *Structural Components:*

Envelope – It has a vaulted ceiling. The immense size and number of openings in the walls make the shelter unstable.

Material – Cardboard

- Construction method: Every sheet is an 8’x4’ (20 x 10 cm) rectangle folded to construct the shelter. Components required to build the shelter and the instruction of deployment with a proposed plan are shown in figures 4.20 to 4.22.

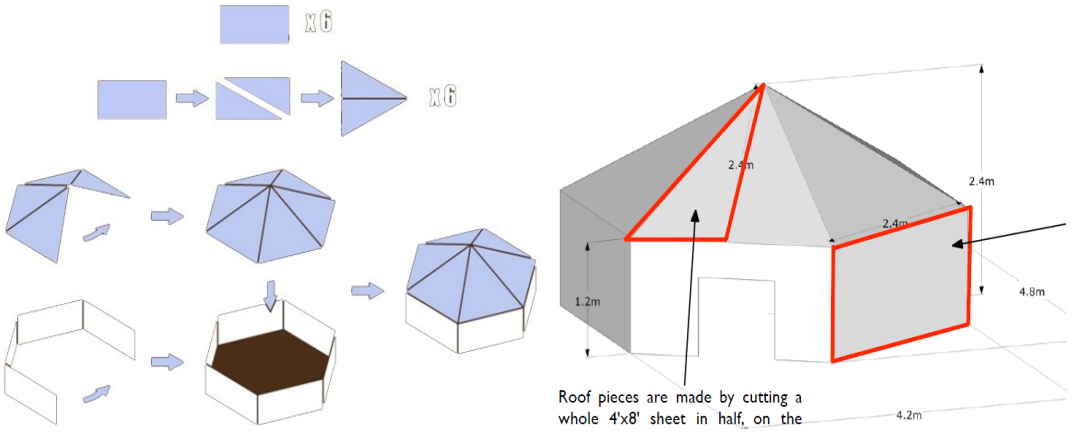


Figure 4.20 : An 8’x4’rectangle sheet of Hexayurt (http://www. tilings .org .uk /Hexayurt_Family.pdf).

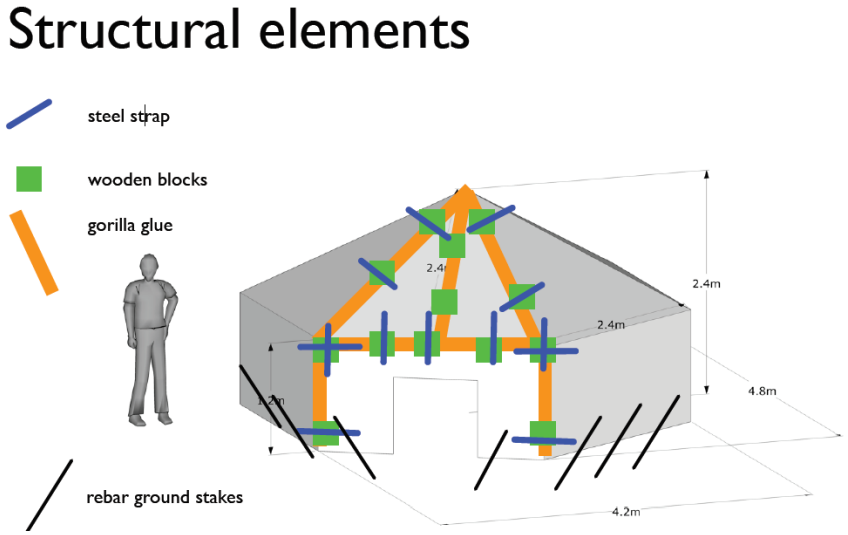


Figure 4.21 : Structural elements in constructing process of Hexayurt (http://files. howtolivewiki.com/EWB_Sheffield_plywood_hexayurt/).

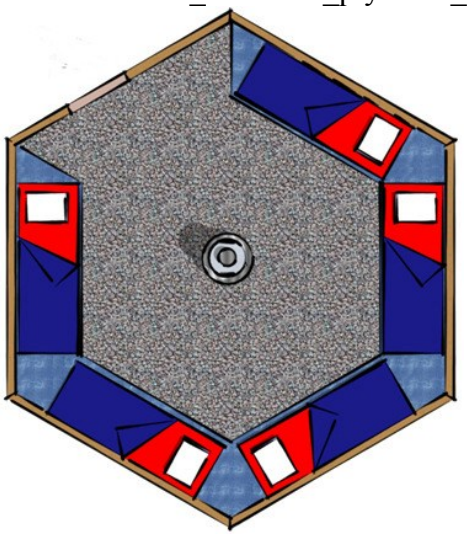


Figure 4.22 : Suggested area of a Hexayurt Plan can hold five persons (Daan van Kinderen and Ferry Klos, 2009).

A coating is required to emphasize ventilation (see figure 4.23).

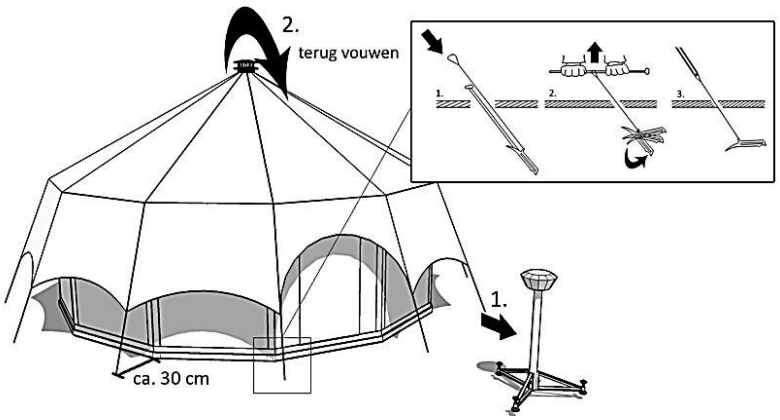


Figure 4.23 : Ventilation flow of Hexayurt (Daan van Kinderen & Ferry Klos, 2009).

- Case Study: Haiti Earthquake – 2012: In this zone, the risk of tropical storms leveling shelters is extremely severe.

- Material used: plywood, OSB or a similar engineered wood product because it handles humidity effectively.
- The Hexayurt will withstand under expected hurricane and wind conditions in Haiti. Wood is flammable material especially in tropical zones, which are prone to drought and heavy rain like Haiti, so Hexayurts used in there were well fireproofed under standard drought conditions.

4.3 Temporary Housing that Can be Converted to Permanent Housing

In this thesis, this type of sheltering belongs to those classification of buildings that have been designed by the purpose of improvement in the future. It means by a little change in the structure of the buildings, they can be used for longer time.

4.3.1 Temporary housing that can be converted to permanent housing – group 1

This part encompasses core housing; transitional community (T-shelter) and pallet house.

MUTUAL CONCEPT: To Provide Self-help incremental housing, they are all used to be 'growing' houses.

4.3.1.1 Core housing – 2008

An introduction to this type of shelter is identified in five steps: Definition, Specification, Expansion process and Case study I and Case studyII:

- Definition: The prefabricated house is made using composite material that the designer calls 'totally miraculous'. Dubbed the 'core house', this light, expandable temporary dwelling accommodates eight people (URL-8). They are used to be 'growing' houses.

- Specifications:

A. *Shelter Function:* Temporary Shelter Converted to
B. *Users:* Natural Disastrous Victims – It can withstand earthquakes and hurricanes and it is also used for Slum and Squatter Settlements.

C. *Climate:* It is used in various climates depending on the materials used.

D. *Structural Components:*

Envelope – It has bunked style beds. The extending roof makes a canopy to provide shade shelter and space for possible outdoor cooking.

Material – Light composite materials

Entrance – The entrance can be identified easily.

- Expansion process: Here is for example a model that can be extended 3 times.

- In the first phase, the core is 20 m2 in area.

- In the second phase, a slope roof is added while the upper floor is used as storage for agricultural products.

- In the third and final phase a second floor is added

Figure 4.24 conceives the expansion of the shelter.

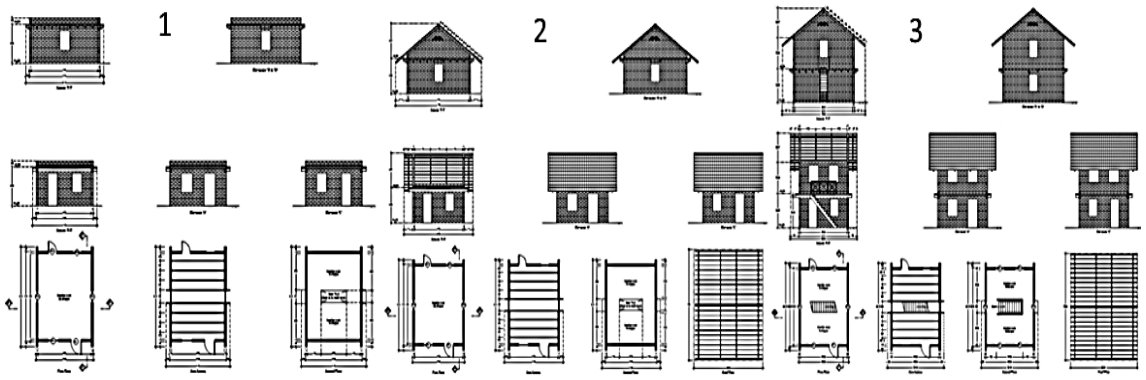


Figure 4.24 : Expansion, over time, in the core house stages (http://www.greendiary.com/entry/).

- Case study I: Haiti earthquake – 2010:

Miami architect designs 'core house' for Haiti's homeless: Good news for the Haitians who were left without a roof over their heads after the devastating tremor shook Haiti. Andrés Duany, a renowned Miami architect and planner is here with a solution for dealing with the post-quake housing crisis. A prototype of the Haiti house is being fabricated at a Miami Gardens factory (URL-9), (see figure 4.25).

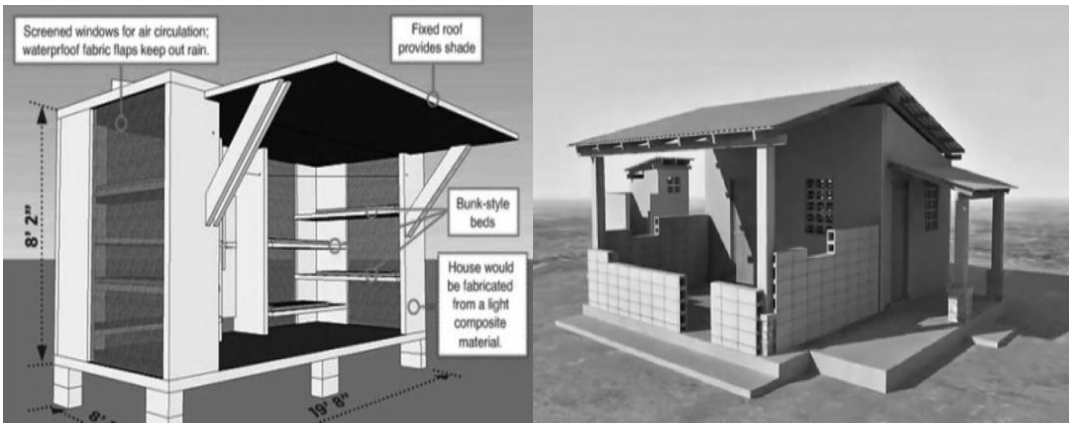


Figure 4.25 : Core House, a prototype for Haitian victims (http://www. greendiary. com/entry/).

Landless Haitians: Since these are not considered permanent but temporary accommodations, no land title or proof of ownership is required. In many case the building material used are or were imported augmenting their construction costs.

- Case study II: El Salvador, self-help and incremental housing – 2008:

In 1950s, a vast majority of city migrants went to squatter settlements (Informal self-builders in settlements outside of the formal process: commonly squatters) – tugurios - on invaded land. Later in order to explore ways to help poor build their own houses, a local NGO, FUNDASAL developed an innovative and participatory process to develop affordable land with infrastructure where low-income families could build their houses at a pace they could afford. They used the approach of resident participation and mutual-help in building core units as was done in El Salvador. It is a project to provide site and service and help enable and promote incremental housing processes as a model for national low – income-housing policy (George Gattoni, 2011).

"Intermixed Settlements throughout City"**:** This informal zone has been legalized and recognized in the city and basic core houses were implemented. Houses are not part of a larger homogenous area of informally or formally developed area. The poor settlements were allowed to improve their houses by getting. In figure 4.26 a and 4.26 b the site of the incremental houses in El Salvador and expanding process are shown.

Figure 4.26 : Core house incremental housing example: Top to below - (a) El Salvador in a formal site and services project, 2008, (b) Squatter settlements expanding process: very successful-successful-little or no expansion, El Salvador, (http:// web. mit. edu/ incrementalhousing/).

Stages of expansion; every neighborhood shows a range of improvements, from those that were very successful to those that have not managed to progress beyond a basis beginning (URL-10).

4.3.1.2 Transitional community (T-shelter) – 2004

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: This achieves two goals: First, it allows humanitarian aid agencies to provide shelter on temporary sites rather than waiting for land-use issues to be resolved. Second, it can help defray families' construction costs for building permanent housing by giving them materials that they can later sell or repurpose (Ron Slagen, 2007).

- Specification:

A. *Shelter Function:* Temporary Shelter Converted to Permanent Shelter
B. *Users:* Natural Disastrous Victims
C. *Climate:* Depending on the materials, the shelters can withstand various climates.
D. *Structural Components:*

Envelope – This is the extension of the pitched roof creates a porch that makes the building's surrounding shaded.

Entrance – Entrance has been identified by using sheets over the ceiling, creating a favorable space.

Material – Basically, box-bar metal frames. Various-local material is preferred.

- Construction method: The construction is undertaken according to the figures 4.27 to 4.29.

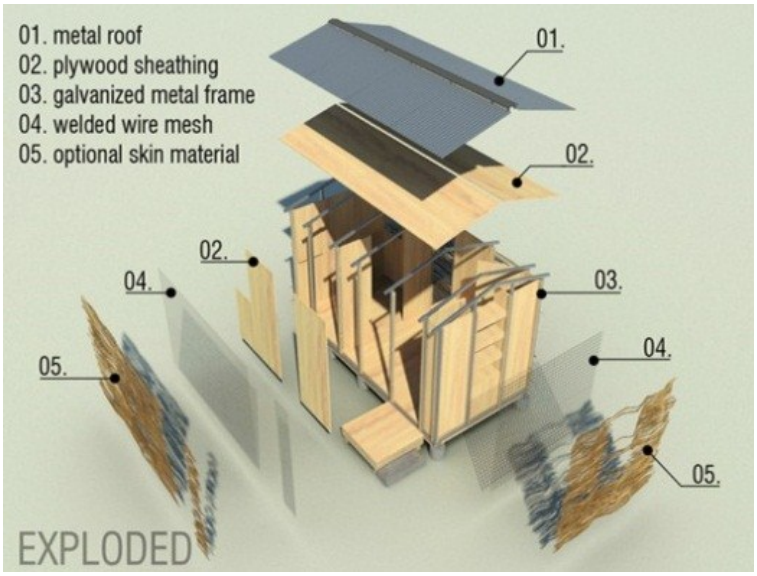


Figure 4.27 : Exploded Axon of transitional community system - Courtesy of David Lopez(http://www.archdaily.com/190673/).

Figure 4.28 : OXFAM's transitional Shelter (T-shelter) design in the South of Sri Lanka (Sandra D'URZO, 2006).

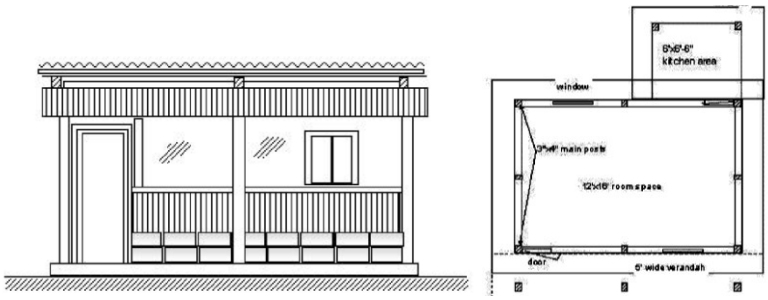


Figure 4.29 : T- shelter front view- A Typical Floor Plan used in the disastrous areas in Sri Lanka (Sandra D'URZO, 2006).

- Case study: Sri Lanka- in the immediate aftermath of the disaster – 2004:

- Location: Tangalle, Hambantota, Sri Lanka
- Organization: Oxfam, Great Britain
- Area: 5.382 ft^2/ 500 m^2
- Over 70,000 transitional shelters were built.

The tsunami of 26 December 2004 hit Sri Lanka two hours after the initial earthquake and killed over 35,000 people along the eastern and southern coasts. It destroyed approximately 100,000 houses and damaged or destroyed much of the infrastructure and public buildings in the affected areas. Organization provided metal-framed shelters with corrugated roof sheeting that people could erect on their own plots of land. An example house in Sri Lanka is shown in figure 4.30.

Figure 4.30 : Transitional shelter, Tangalle, Hambantota, Sri Lanka (Sandra D'URZO, 2006).

4.3.1.3 Pallet house – 2006

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: Pallet House by I-Beam Design was conceived as a transitional shelter for returning Refugees. An alternative shelter to replace the tents, designed for people displaced by natural disaster in Kosovo, back in 2006.

- Specifications:

A. *Shelter Function:* Temporary Shelter Converted to Permanent Shelter

B. *Users:* Natural Disastrous Victims – It is a shelter for the earthquake refugees. Homeless people – Potentially homeless people in USA consume different materials to build their own houses using the pallet house method

C. *Climate:* Used In various climates

D. *Structural Components:*

Envelope - A steeper pitch could be done but it would require longer pallets or splicing normal pallets together. A pitched roof adds extra vertical space for a sleeping loft and is purely an aesthetic choice. Attached terrace to the roof shades the building circumstance.

Material – Local low cost and reusable materials are preferred.

- Construction method:

Step 1: *Build the Shipping Pallet Floor*-the shipping pallet often made of hardwood can be extended over a trailer or concrete slab. The open ends of pallets will be attached to the 2"x4" dimensional lumber, which can be later detached and reused again. In the subsequent phase, the pallets are connected to each other via nails and screws [See the figure].

Step 2: *Lay the Floor* – attaching 4×8 sheets of plywood or another sturdy sheet material to the pallet subfloor, if need the insulation materials also can be added to the pallet.

Step 3: *Raise the Walls* – lifting the prepared pullets and arranging them like the method in bricks.

Step 4: *Add Windows and a Door* – cutting the holes to hold the door and windows' bucks.

Step 5: *Building the Walls and Roof* – adding a top plate on top of the walls to tie all the pallets together.

Step 6: *Roofline and Cross Section (Pitched Roof)* – providing a pitched roof by using longer pullets which can be used as a sleeping loft later. The end height is about 8 feet high, the pitch illustrated is a 3:12 pitch (drops 3 inches for every 12 inches horizontally). The lower wall is about 80 inches high.

Step 7: *Interior and Exterior Sheathing* – to make the building insulated of the weather and air, the interior and exterior parts of the building should be sheathed by 4′x8′ sheets of the most weather resistant material.

Figures 4.31 to 4.34 indicate step of constructing and the prototype plan.

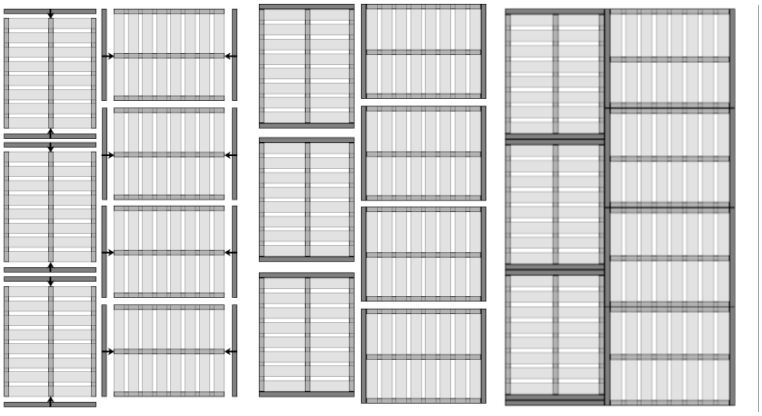


Figure 4.31 : Step 1-attaching the shipping pallets in a pallet house (http://www. tinypallethouse.com).

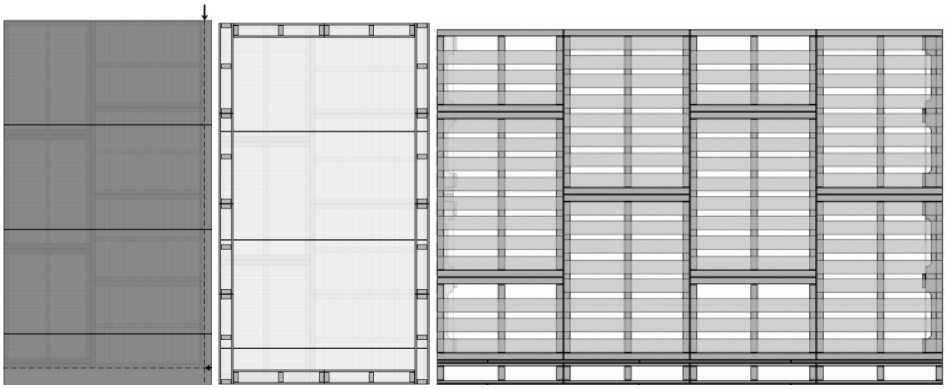


Figure 4.32 : Step 2 & 3 in a pallet house (http://www.tinypallethouse.com).

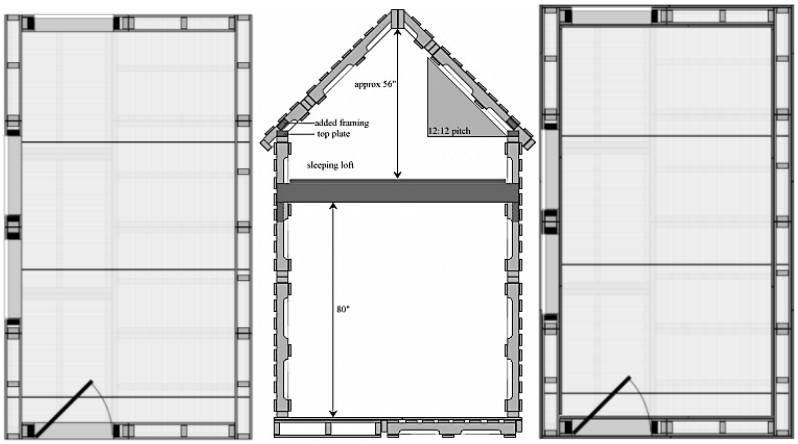


Figure 4.33 : Step 4 & 5 in a pallet house (http://www.tinypallethouse.com).

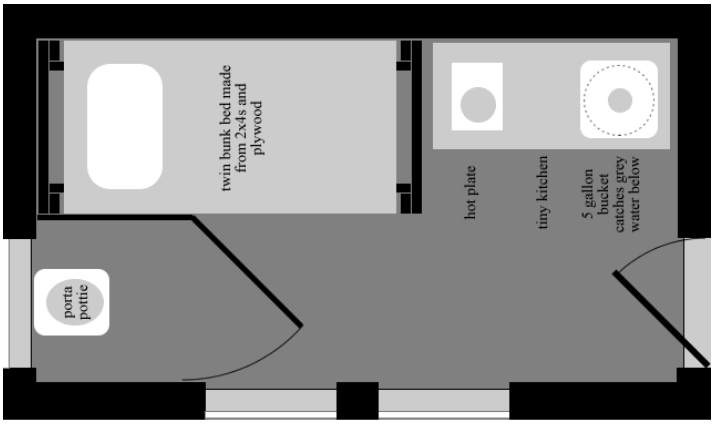


Figure 4.34 : The concept of the prototype plan in a pallet house (http://www.tinypallethouse.com).

- Case study: Sustainable housing for San Pedro de Alcantara, 6th Region Chile, Mexico: Using recycled construction materials from damaged houses and donated pallets to improve the living conditions of those poor living in substandard housing. Figures 4.35a and 4.35b indicate step of constructing and the prototype plan.

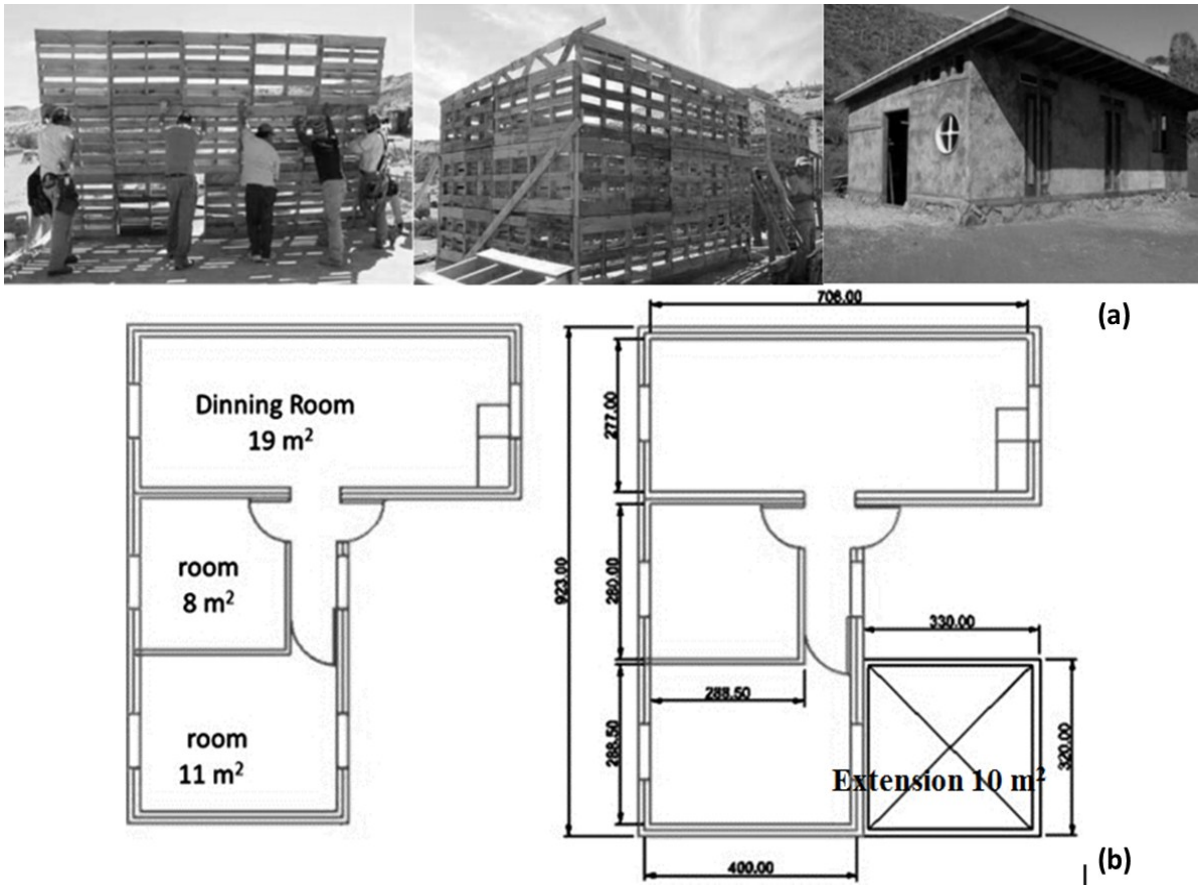


Figure 4.35 : Pallet house prototype: (a) The process of pallet house construction, (b) The plan of the pallet house example (http://unitingalcantara.wordpress.com/2010/05/15/).

4.3.2 Temporary housing that can be converted to permanent housing – group 2

This part encompasses superadobe, sand bag shelter, eco-dome; rubble house and paper log houses.

MUTUAL CONCEPT: To Provide Affordable eco shelters to prove self-built shelter.

4.3.2.1 Superadobe, sand bag shelter, eco-dome – 1995

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: The sandbag or 'superadobe system' is a prototype for temporary housing consists of sandbags and barbed wire as the materials of war to provide sustainable and affordable shelters. These shelters, designed by Nader Khalili meet United Nations standards.
- Specifications:

A. *Shelter Function:* Temporary Shelter Converted to Permanent Shelter
B. *Users:* Natural Disastrous Victims and War-Torn Victims
C. *Climate:* Cold and Mountainous, Dry and Hot
D. *Structural Components:*

Envelope – The homogenic structure of the shelter which knit the body to the earth and is the sand from top to toe, makes the shelter more resistant.

Entrance – It can be easily identified.
Material – Sandbags and barbed wire as the materials of war.

- Construction method:

The basic construction technique involves filling sandbags with earth and laying them in circular courses that are corbelled near the top to form a dome with vernacular design concept to prove self-built shelter. Barbed wire laid between courses prevents the sandbags from shifting and provides earthquake resistance (see figure 4.36).

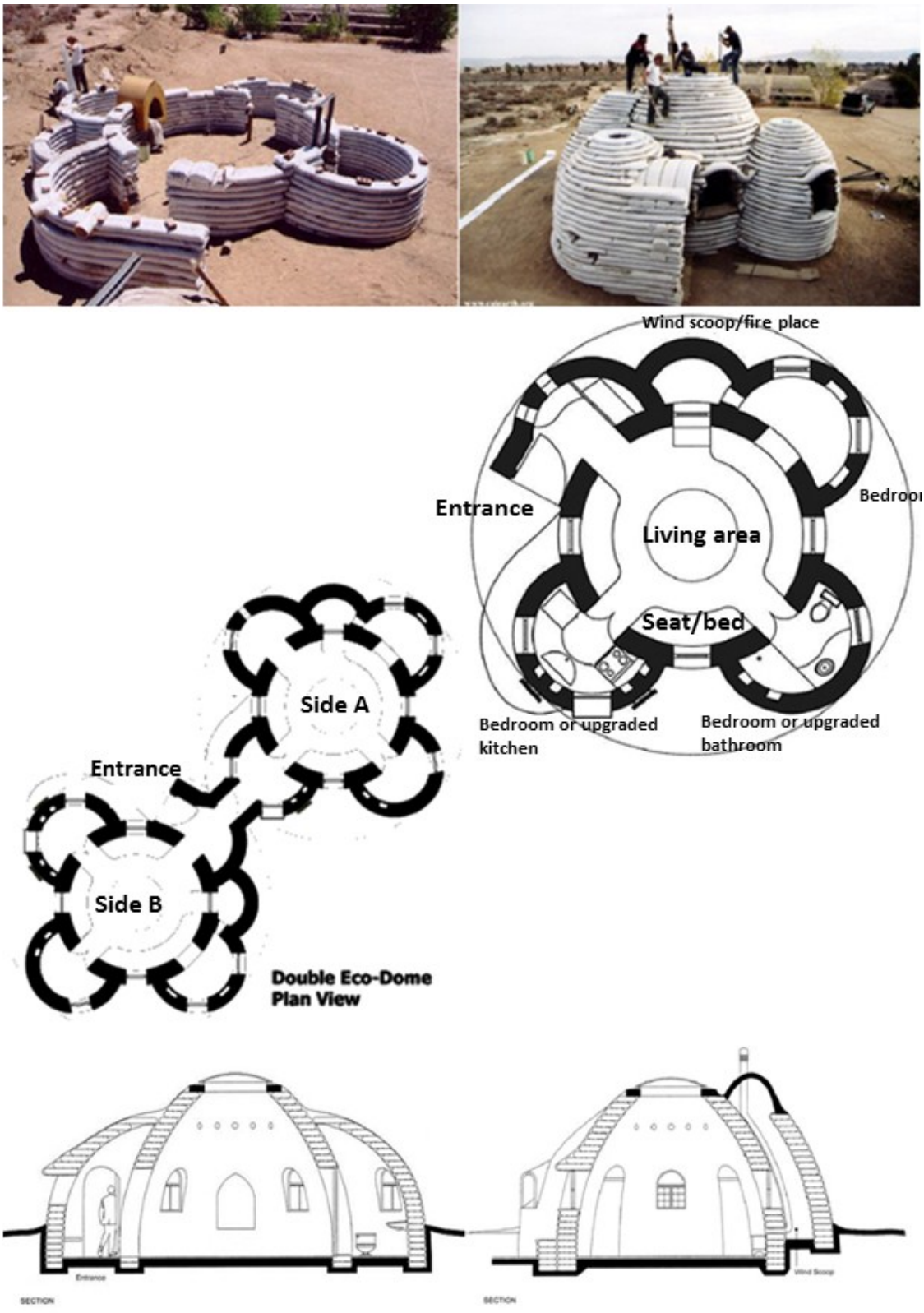


Figure 4.36: The prototype concepts of superadobe system (Karin Freij, 2008).

- Case studies: Prototypes have been built to date in Brazil, Canada, Chile, India, Mexico, Iran, Russia (Siberia), Thailand and the US, shown in figures 4.37a to 4.37e.

Figure 4.37 : Superadobe examples: (a) Baninajar Refugee Camp in Iran for Iraqi refugees in 1995, (b) Temporary shelter using superadobe method in Mexico, (c) Temporary shelter using superadobe method in Canada, (d) Temporary shelter using superadobe method in Brazil, (e) Temporary shelter using superadobe method in India, (2004 Review Report, 2004).

The upgrading example is shown in figure 4.38.

Figure 4.38 : Temporary shelter can be upgraded into permanent housing (http:// www.busyboo.com/2008/10/13/superadobe-earth-home/).

4.3.2.2 Rubble house – 2006

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: A 'rubble house' known as the 'Stonehouse' was designed by Mike Lawless to demonstrate the construction of a low-cost aesthetically pleasing and energy-efficient eco-home using recycled building materials. This project involves entrapping rubble in wire mesh cages and developing the Gabion system normally used for retaining walls into a simple architectural system.
- Specifications:

A. *Shelter Function:* Temporary Shelter Converted to Permanent Shelter
B. *Users:* Natural Disastrous Victims
C. *Climate:* Used in various climates
D. *Structural Components:*

Envelope – The system is not intended for use in urban multistory structures.
Material – Steel mesh casing (Gabion) modules filled with one meter cube of concrete rubble.
Stones are used as they are, or roughly shaped and laid with wide joints.

- Construction method: Only medium to light civil equipment are needed to collect, move, fill and lift the 'Gabion' modules. The system's vertical structure is composed of steel mesh casing (Gabion) modules, each filled with one meter cube of concrete rubble. The system floor is the same as the vertical elements, complemented by pouring an 8cm slab as finish. The system roof is out-of-factory modular lightweight steel insulated sandwich panels over a primary light steel structure. There is no need for an external finish: the walls can be covered with greenery (URL-24).
- Case study: Lebanese – 2006: This method was developed in response to the urgent need for housing in Lebanese villages targeted by air raids in summer 2006. Figure 4.39 shows the concept of the method.

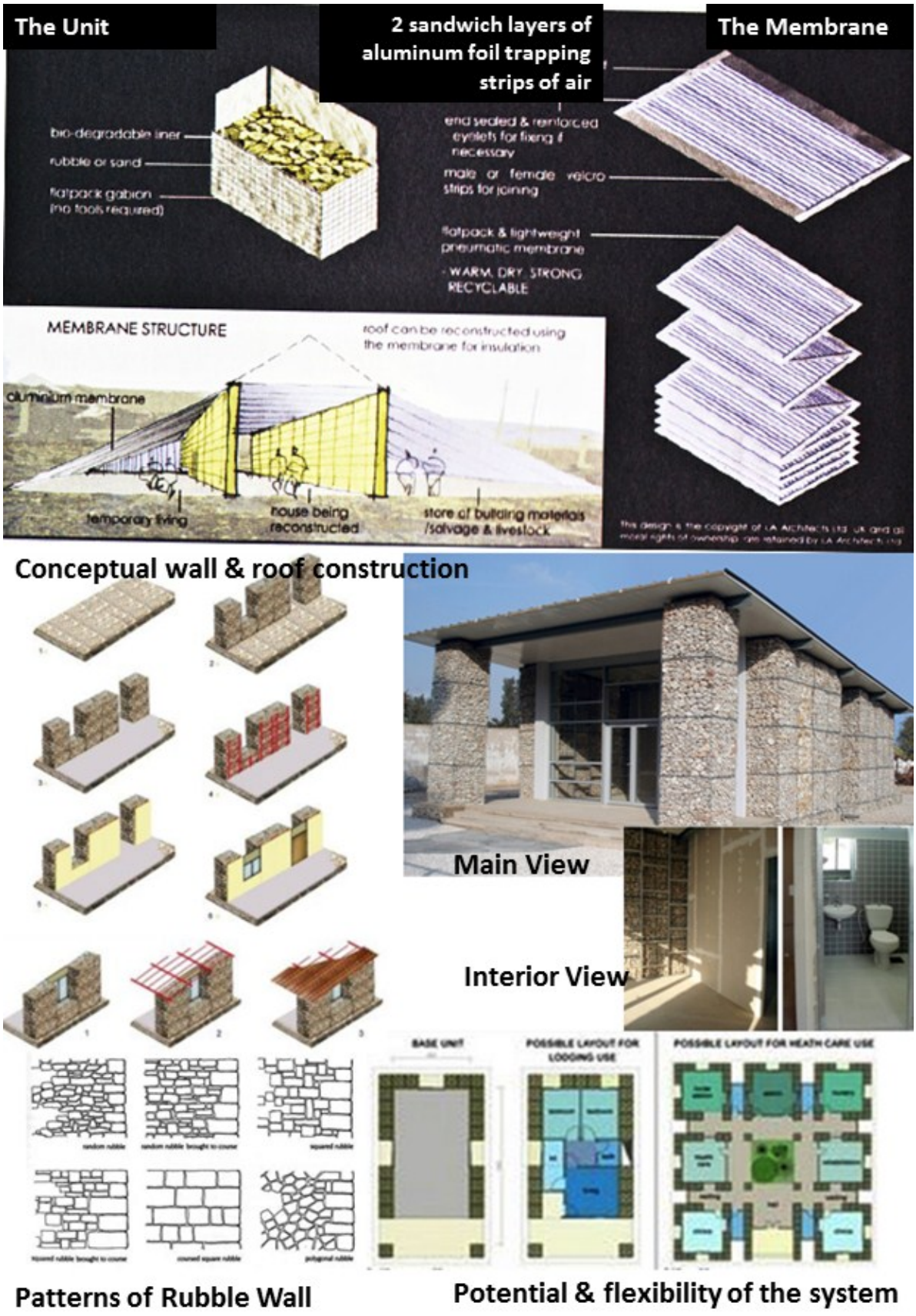


Figure 4.39 : Rubble House Concept (http://ephemeralspaces.blogspot.com/ & http://en.urbarama.com/project/project-r-the-rubble-house).

4.3.2.3 Paper log houses – 1995

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: The paper log houses by architect Shigeru Ban are assembled from paper tubes. He constructed the first paper log house in 1995, in Kobe, Japan, as a post-earthquake shelter. The paper log house has been used in multiple post-disaster contexts.
- Specification:

A. *Shelter Function:* Temporary Shelter Converted to Permanent Shelter
B. *Users:* Natural Disastrous Victims
C. *Climate:* Used in various climates
D. *Structural Components:*

Envelope – It has a pitched roof with tenting material for the roof.
The walls are made of tube paper.
Material - Recycled inexpensive materials like cardboard are used.

- Construction method: 01- socket, 02 - panel plywood, 03 - Tubes diam, 108 MM, E = 4MM, 04 - plywood panel, 05 - waiting cruciform on plywood to anchor pipe, 06 - wall mount noncontiguous, 07 - second phase of wall + horizontal reinforcement by steel rods 6MM, 08 - profile plywood or by collecting the heads of the pipes (See figure 4.40).

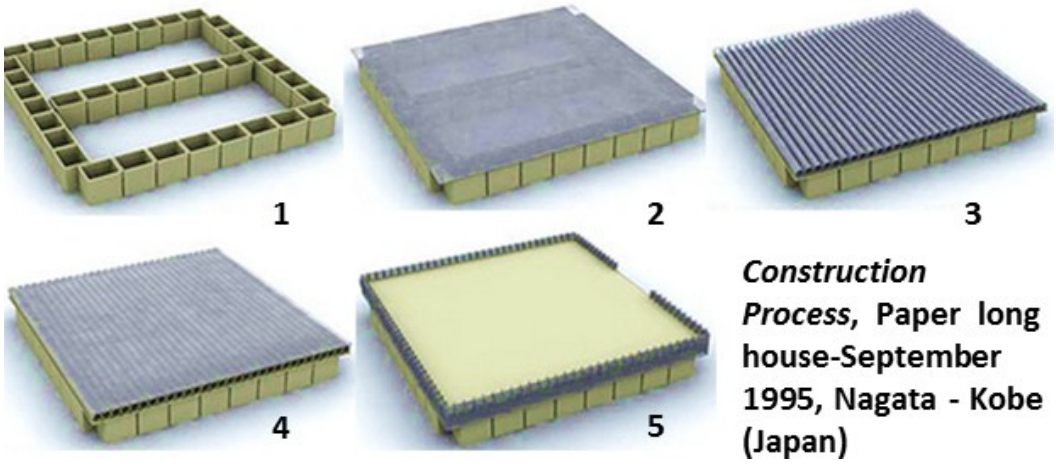


Figure 4.40 : Conceptual design and built prototype of Paper Log House (http:// whatwow.org/paper-log-houses/ & http://www.flickr.com /photos/ nachetz/6075942168/in/).

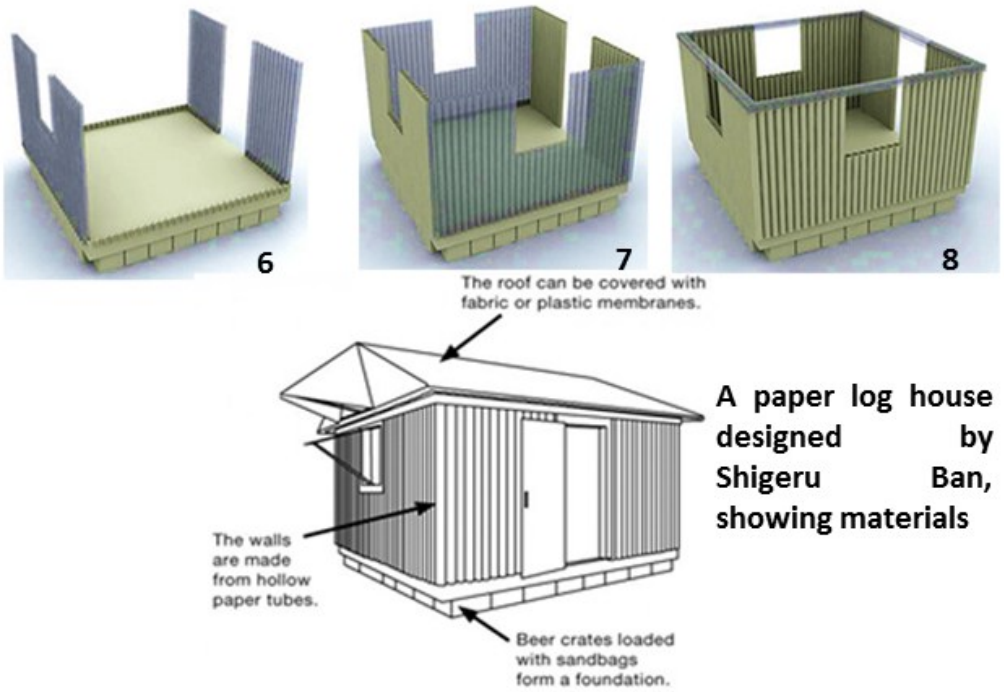


Figure 4.40 (continue) : Conceptual design and built prototype of Paper Log House (http://whatwow.org/paper-log-houses/ & http://www.flickr.com /photos/nachetz/6075942168/in/).

- Case Studies: Kobe, Japan, 1994 / Kaynasli, Turkey, 2000 / Bhuj, India, 2001:

<Turkey> Based on the shelter in Kobe, Japan, some improvements were applied to fit in with the environment in Turkey.

<India> What makes the India's log house unique is the foundation and the roof. Rubble from destroyed building was used for the foundation instead of beer crates, which could not be found in this area. It was coated with a traditional mud floor. Figure 4.41 shows the examples.

Figure 4.41 : Log house examples: Left to right - Temporary "log" houses built for the victims of the earthquakes in Kobe, Japan, 1994; Kaynasli, Turkey, 2000 and Bhuj, India,2001 (http://www.shigerubanarchitects. com/ SBA_WORKS/).

4.3.3 Temporary housing that can be converted to permanent housing – group 3

This part encompasses safe [r] house, aero house (AH) and monolithic eco-shells.

MUTUAL CONCEPT: To Provide low-tech construction, high-tech design shelter.

4.3.3.1 Safe [r] house – 2005

An introduction to this type of shelter is identified in 1four steps: Definition, Specification, Construction method and Case study:

- Definition: TDI Tsunami design initiative is a student initiative at Harvard design school that was set up in response to the rebuilding efforts in the south Asian coast after the tsunami in December 2004.

In March 2005, TDI won the tsunami challenge competition with the challenge of providing a shelter with high-tech design and low-tech construction.

- Specifications:

A. *Shelter Function:* Temporary Shelter Converted to Permanent Shelter
B. *Users:* Natural Disastrous Victims, Migrants and Refugees
C. *Climate:* Used in various climates
D. Structural Components:

Envelope – The walls are made of reinforced concrete. Figure 4.42 shows the concept of the style.

- Construction method: After this tsunami, numerous tests were carried out; the results proved that the elements perpendicular to the tide waves have more resistance. Regarding these findings, a new construction method was patented. The new method introduces steel reinforcement bars into the concrete block walls and steel structural ties to the foundations. On the other hand, it redesigns the exterior enclosure of the building by "folding" the exterior walls into four structural "cores" at corners of the house (Thusyanthan, I. and Madabhushi, G. (n. d)).

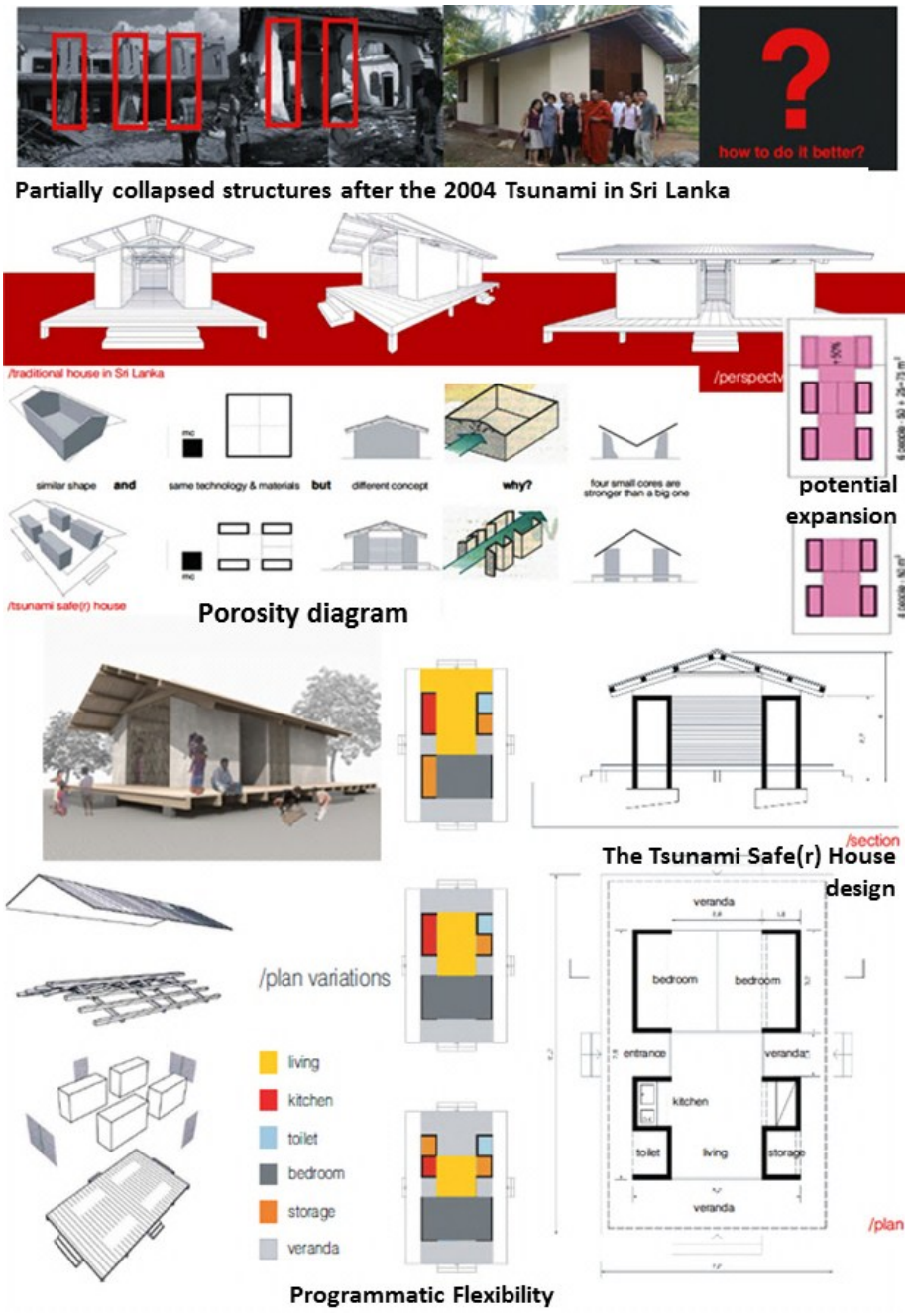


Figure 4.42 : Conceptual design and built prototype of Safe R House (Thusyanthan, I. and Madabhushi, G. (n. d)).

In figure 4.43 the ventilation of the system is modelled.

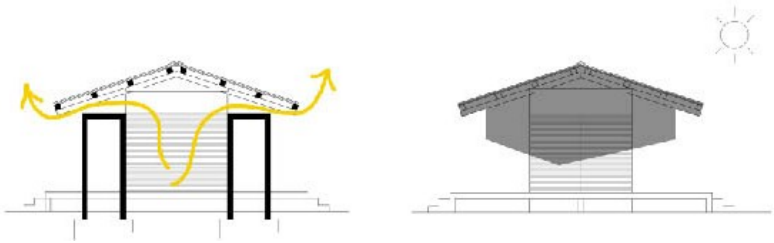


Figure 4.43 : Safe(r) House ventilation system (http://senseable.mit.edu/tsunami-prajnopaya).

- Case Study: Balapitiya (Sri-Lanka) – 1995: It is designed by carlorattiassociati, MIT Senseable City Lab, 2004. The first prototype of the tsunami safe(r) house has been completed in September 2005 in Balapitiya, Sri Lanka (See figure 4.44).

Figure 4.44 : Prototype example of safe R house (http://www.jovoto.com/ blog/).

4.3.3.2 Aero house (AH) – 1999

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: The genesis of Tadashi Murai's prototype, known as the Aero House is an ultimate green transformation house, occurred in 1999, as the result of a commission to provide a reception area and office at a woodland cemetery as sustainable as possible (URL-22). It is a modular, portable green (reusable materials, green roof and gray water recycling for green roof) shelter that has little impact on the environment.
- Specification:

A. *Shelter Function:* Temporary Shelter Converted to Permanent Shelter
B. *Users:* Natural Disastrous Victims – Earthquake resilient building, because holds the furniture between the pillars so there will be nothing to fall.
C. *Climate:* It is resilient in any weather.
D. *Structural Components:*

Entrance – It can be easily identified.

*Materia*l – Frame: Engineer wood, Skin: plywood (wall, ceiling, roof and floor), it is made of local material. In the figure 4.45 concept of the construction system is shown.

- Construction method: First, the wooden structure must be lined-up, and then plywood for roof, floor and wall should be used. The finishing Materials, set insulation roof and windows. It is a mobile house and can be transported.

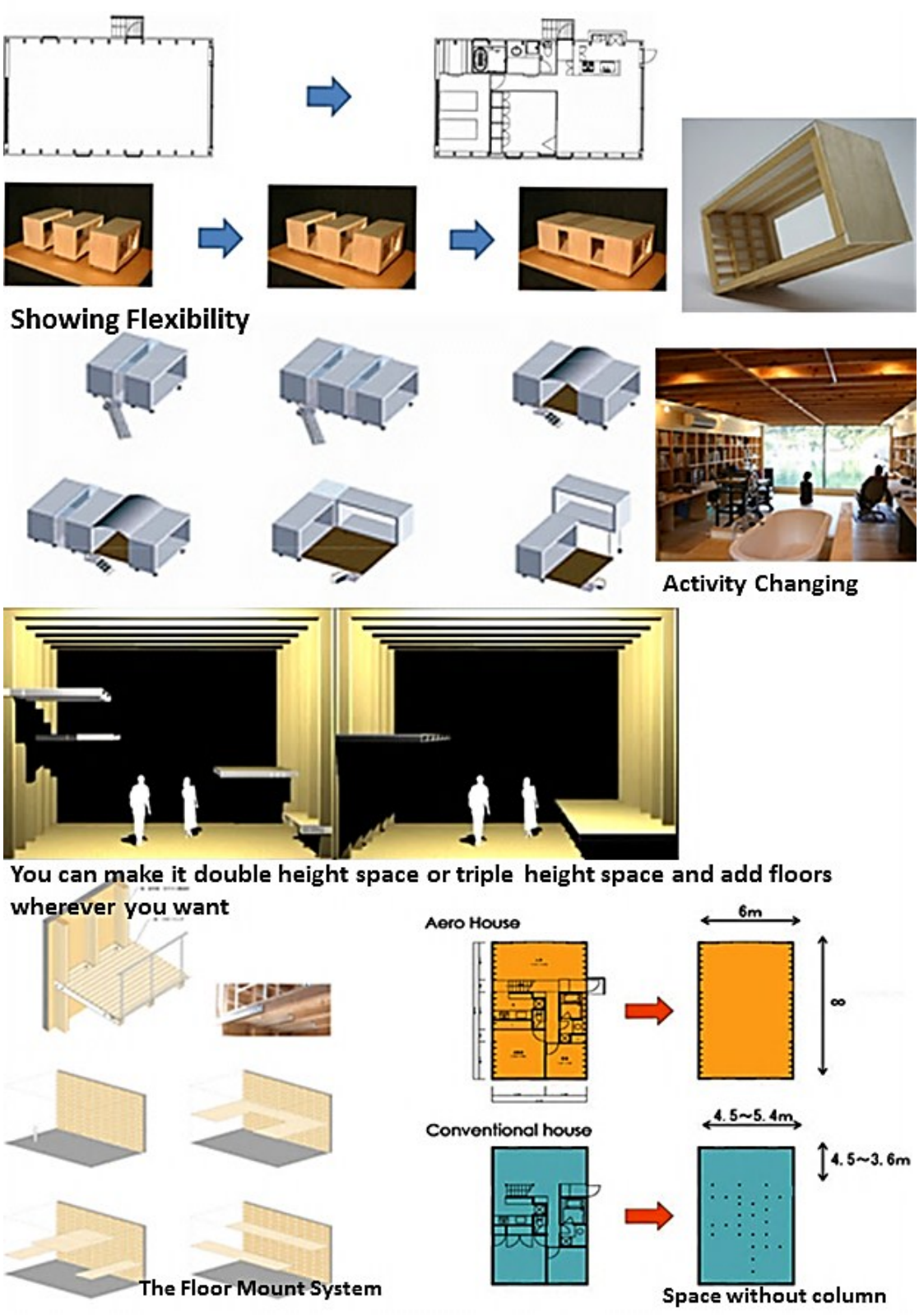


Figure 4.45 : Conceptual design and built prototype of AH (http://www.aerohouse.net/).

The basic plan for a complex building and the prototype plan are shown in figure 4.46.

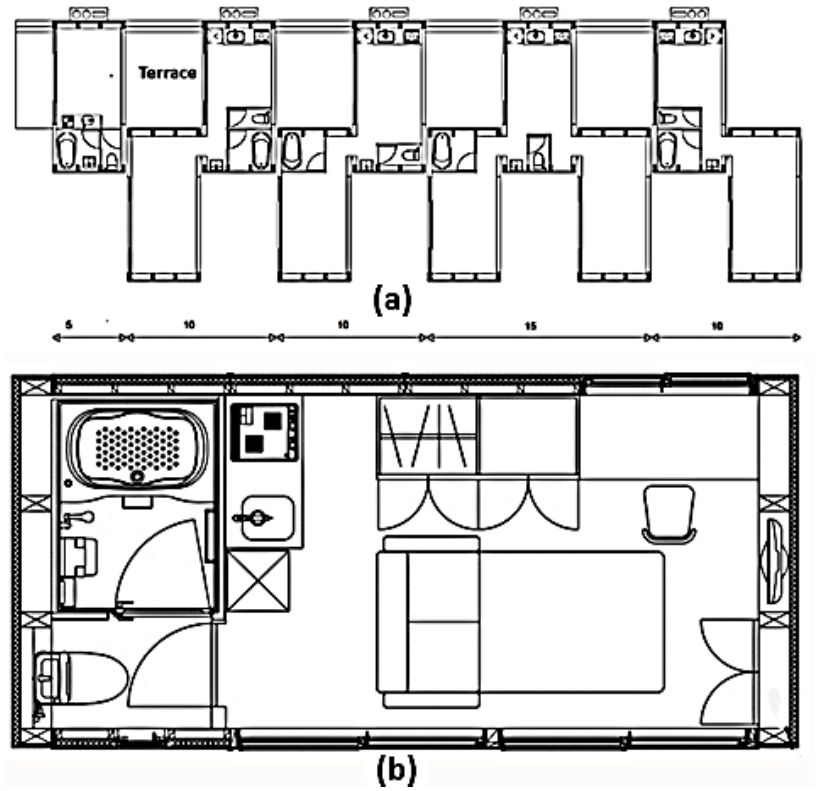


Figure 4.46 : Aero house plans: (a) Basic plan for family households 10 to 5 in an Aero House (Aero House, 2011). (**b)** Prototype plan of an Aero House (Aero House, 2011).

Figures 4.47 to 4.49, show the advantages of the construction method.

Figure 4.47 : Adding balcony and another AH and more (http://www.youtube.com/ watch?v=A1P4aUkNIus).

Figure 4.48 : One can lengthen the columns to create the car space underneath in an Aero House (http://www.youtube.com).

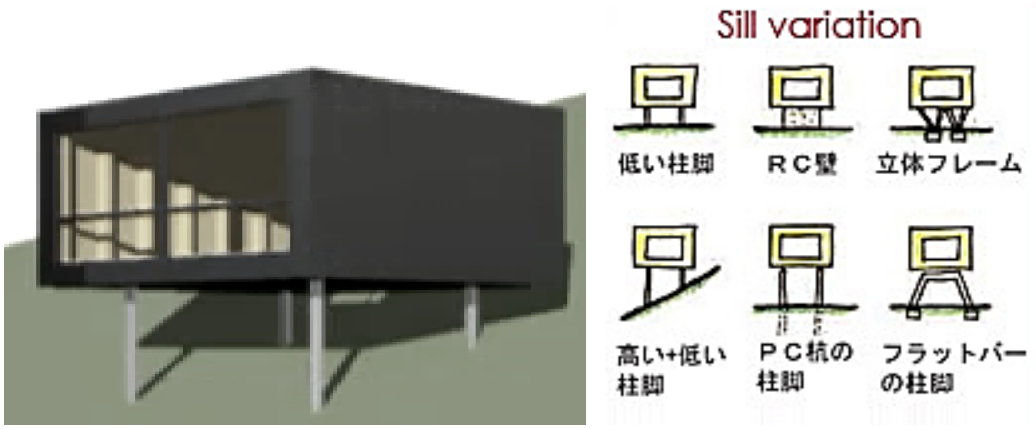


Figure 4.49 : Adaption to various terrains of Aero House (http://www.youtube.com/watch?v=A1P4aUkNIus & http://www.aerohouse.net/).

4.3.3.3 Monolithic eco-shell

Sometimes there is no need for the insulation layer of the dome; these types of domes are named Eco-Shell domes.

An introduction to this type of shelter is identified in four steps: Definition, Specification, Construction method and Case study:

- Definition: ***Eco-Shell*** means *economical, eco-friendly and thin shell*. This is a good example for a disaster relief shelter turning into a permanent housing solution designed for developing countries. The thickness of the concrete layer in the Eco-Shells is two or three inches and a modest amount of rebar. Compared to conventional, rectangular buildings with the same square footage, Eco-Shells use less than 50% of concrete and rebar in their construction. The prototype plan is schemed in figure 4.50.

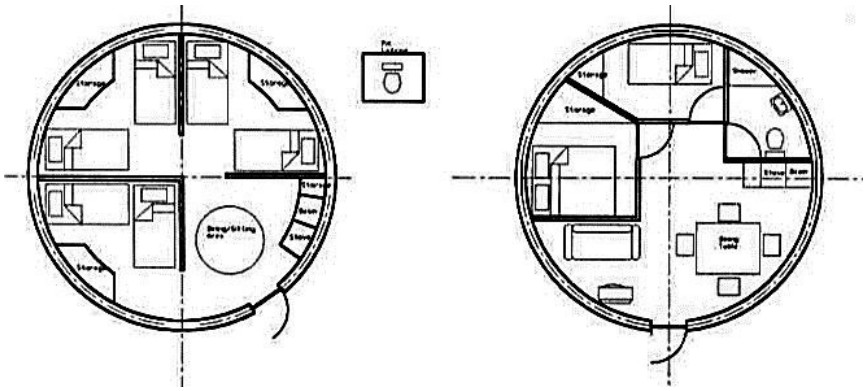


Figure 4.50 : Typical plan of Eco-Shells, Possible Internal Arrangements for Low-Cost Houses (G. Talocchino, 2005).

- Specifications:

A. *Shelter Function:* Temporary Shelter Converted to Permanent Shelter
B. *Users:* Natural Disastrous Victims
C. *Climate:* Cold and Mountainous, Dry and Hot
D. *Structural Components:*

Envelope – Canopies can be generated by making hollows or attaching awning.

Material – Concrete and rebar – 2-3 inches of concrete, a modest amount of rebar.

- Construction method: In an Eco-Shell, concrete and rebar are employed on the outside of the Air form. (Unlike the construction of a Monolithic Dome; rebar and concrete are placed inside of the Air form). See the figure 4.51 for more visual information.

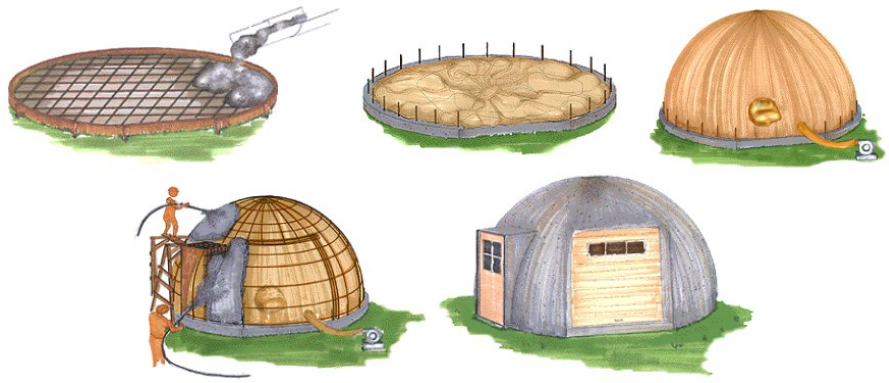


Figure 4.51 : EcoShell dome construction method (http://www.monolithic.com/).

- Case study– 2012: Affordable eco-shells are supposed to use in Haiti (see figure 4.52).

Figure 4.52 : EcoShells in Haiti, low-cost housing (www.monolithic.com).

4.4 Permanent Housing

4.4.1 Permanent housing examples

This part encompassess monolithic dome, sistema arde, quinta monory and structural insulated panels (SIP).

MUTUAL CONCEPT: Creating Low-cost durable housing with humanized façade and interior and allow for the eventual expansion of the dwellings.

4.4.1.1 Monolithic dome– 1976

An introduction to this type of shelter is identified in foue steps: Definition, Specification, Construction method and Case study:

- Definition: It is a one-piece product considered as a form of monolithic architecture with a super-insulated and airform steel-reinforced concrete structure. This thin shell hemispherical shape of the dome is determined as the most disaster resistant building that is logically affordable, developed by three brothers from Shelley, Idaho: Barry, Randy, and David South in 1976. See figure 4.53.

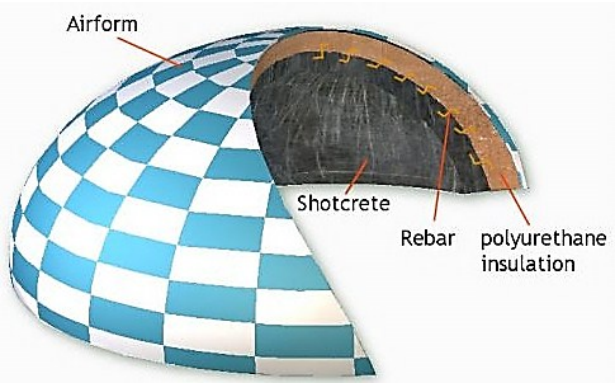


Figure 4.53 : The common layers of a Monolithic Dome (http://www.geo-dome .co. uk/article.asp?).

- Specifications:

A. *Shelter Function:* Permanent Shelter

B. *Users:* Natural Disastrous Victims – They exceed FEMA's standards in providing protection against tornadoes, avalanches, hurricanes, landslides, earthquakes, fires, snow, ice storms and terrorist attacks, thus, making them very suitable for disaster relief shelter applications.

C. *Climate:* It is a weatherproof structure and actually can meet various weathers by considering some equipment.

D. Structural Components:

E. *Envelope* – Sunshade can be provided whether in a geometry shape or natural shape.

Material – Tough, inflatable airform steel-reinforced concrete, polyurethane foam insulation

- Constructing method:

Step 1: a concrete ring foundation, reinforced with steel rebar. **Step 2:** An airform -- fabricated to the proper shape and size – is placed on the ring base. Using blower fans, it is inflated and the airform creates the shape of the structure to be completed. **Step 3:** Polyurethane foam is applied to the interior surface of the airform. **Step 4:** Steel reinforcing rebar is attached to the foam. **Step 5:** Shotcrete -- a special spray mix of concrete -- is applied to the interior surface of the dome (Giulio Neri, Geodesic Domes, (n.d.)). Figure 4.54 shows the construction process.

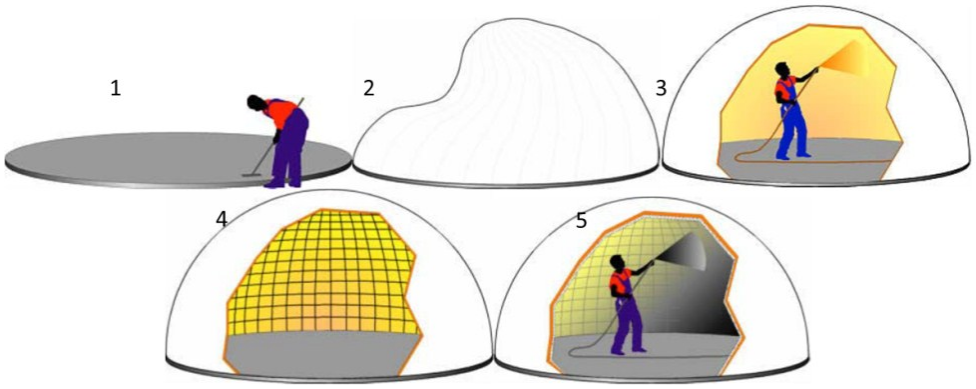


Figure 4.54 : Construction process in monolithic dome (Giulio Neri, Geodesic Domes, (n.d.)).

The airform contains an airlock to allow workers to enter the form while it is inflated. The air form determines the final shape of the dome and becomes a protective cover when the dome is completed. In the manufacturing process, chemicals called plasticizers are added to the airform material that give it flexibility and reduce brittleness.

- Case studies: Florida – 2005, Oklahoma and Texas – 2005 and 2006, Iraq – 1991:

- Several monolithic domes in Florida survived direct hits by Hurricane Katrina in 2005.

- Several monolithic domes were in the path of the 2005 and 2006 wildfires in Oklahoma and Texas, and survived with only slight charring of the exterior foam insulation.

- During the war between Iran and Iraq in 1991, 28 domes containing a mosque and 27 grain storages were constructed by the aid of Iraqis' workers in Iraq in a very short time (4 months and a half). Although the mosque was bombed, except the interior part the dome itself maintained with no harm (see the figure 4.55a and 4.55b).

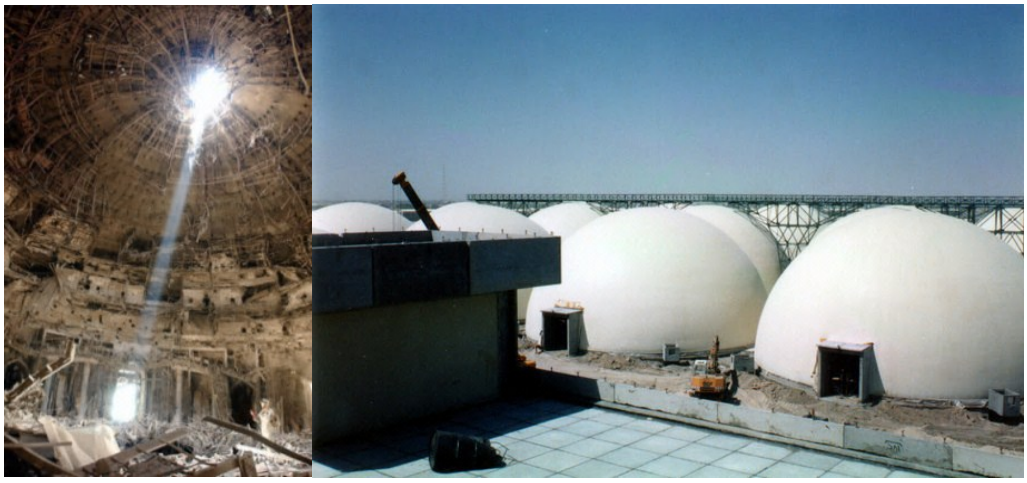


Figure 4.55 : Monolithic dome examples: left to right - (a) Grain Storages in Iraq, (b) The mosque with its durable dome (http://www. ferndaledoubledome.com/).

4.4.1.2 Sistema arde – concrete masonry units (CMU) – 1999

An introduction to this type of shelter is identified in four steps: Definition, Blocks systems, Specifications and Case study:

- Definition: Sistema Arde has been designed by Alejandro Villareal and Pedro Martinez to build in a cheap way self-constructed low incomes houses in Mexico,[2] a patented building system that combines the ease of building with cement-block with the warmth and variety of traditional construction. A complete building system provides improvements in the technical and construction, as well as the quality of life for users. It is a Low-cost durable housing with humanized façade and interior, using structural accessories like planters, windows, steps, closings, and decorative elements.

[2] Design like you give a damn

Blocks System: The system is developed as a puzzle composed of modular blocks, beams, arches and special parts, which meet all the building blocks of housing. The pieces are grouped as follows:

- *Basic technology:* it includes all the pieces that solve the basic structure of the building. This group is mainly blocks, beams and vaults.
- *Structural finishes:* this group helps create the exterior finishes of the building, through pieces that solve not just the structural issues, but also the final finishes as well. This eliminates the need of stuccowork, painting, and their inherent maintenance cost.
- *Structural Accessories:* this set of pieces complement the last two groups, and they solve specific construction needs such as stairs, window frames, fences, planters, parts that facilitate the free passage of the facilities, etc. Figure 4.56 shows the concept of Sistema Arde.

o Specifications:

A. *Shelter Function:* Permanent Shelter

B. *Users:* Slum and Squatter Settlements and Homeless people - Concrete masonry unit (CMU) block is a suggestion to provide a low-cost durable housing to rebuild the sub-standard houses in the poor zones of the cities.

C. *Climate:* Used in various climates

D. *Structural Components:*

Material – Concrete masonry unit (CMU) block that is a low-cost available material.

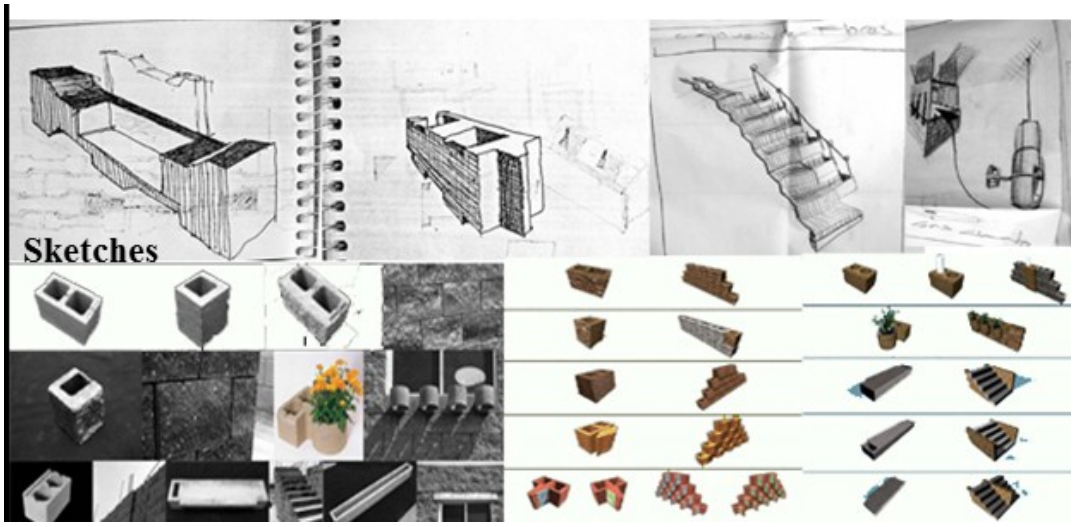


Figure 4.56 : Sistema Arde Concept (http://www.en.hierve.com/).

Figure 4.56 (continued): Sistema Arde Concept (http://www.en.hierve.com/).

- Case Study: San Miguel de Allende, Mexico – 1999: The blocks have been used to construct a number of projects for a group of single-family, low-income houses outside suburb of San Miguel de Allende, Mexico, 1999, the textured façade are created by using a variety of blocks."

The block system is one of the construction systems used in Mexico to build affordable housing, in either the formal housing or informal (URL-26). Figure 4.57 shows Mexico slum settlements that were later substituted by the Sistema Arde building using the method of upgrading self-construction.

Figure 4.57 : Low quality of house in San Miguel de Allende, Mexico (http:// www.en.hierve.com/projects/).

4.4.1.3 Quinta monroy housing project – 1999

An introduction to this type of shelter is identified in four steps: Definition, Blocks systems, Specifications and Case study:

- Definition: Considering people's right to live in their own land to save their social networks, Quinta Monroy Housing Project was born to improve the area, which had turn into sub-standard space. Its main target is creating affordable housing with the aim of maximizing the built footprint on the site and allow for the eventual expansion of the dwellings.
- Specifications:

A. *Shelter Function:* Permanent Shelter
B. *Users:* Homeless people and Slum and Squatter Settlements
C. *Climate:* used in various weathers.
D. *Structural Components:*

Material – Reinforced-concrete & Cement bricks. Concept of the system is shown in figure 4.58.

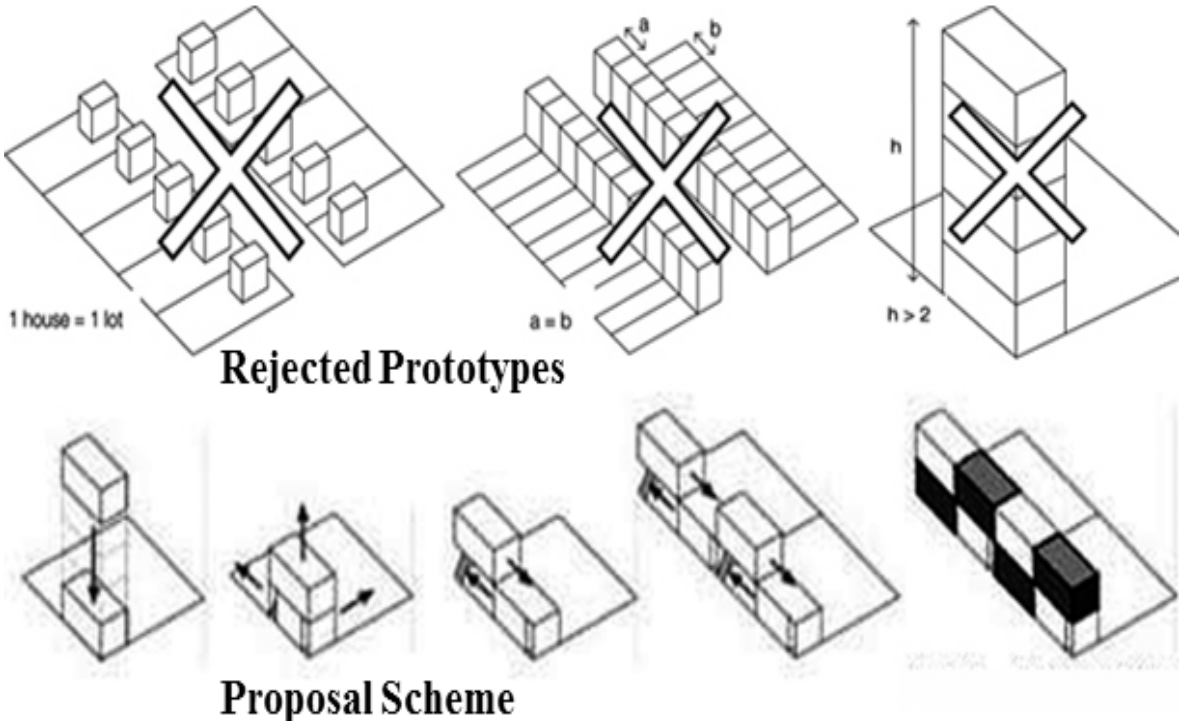


Figure 4.58 : Quinta Monroy Housing Concept (http:// www.moma.org/ interactives/ exhibitions & http://www.archdaily.com/).

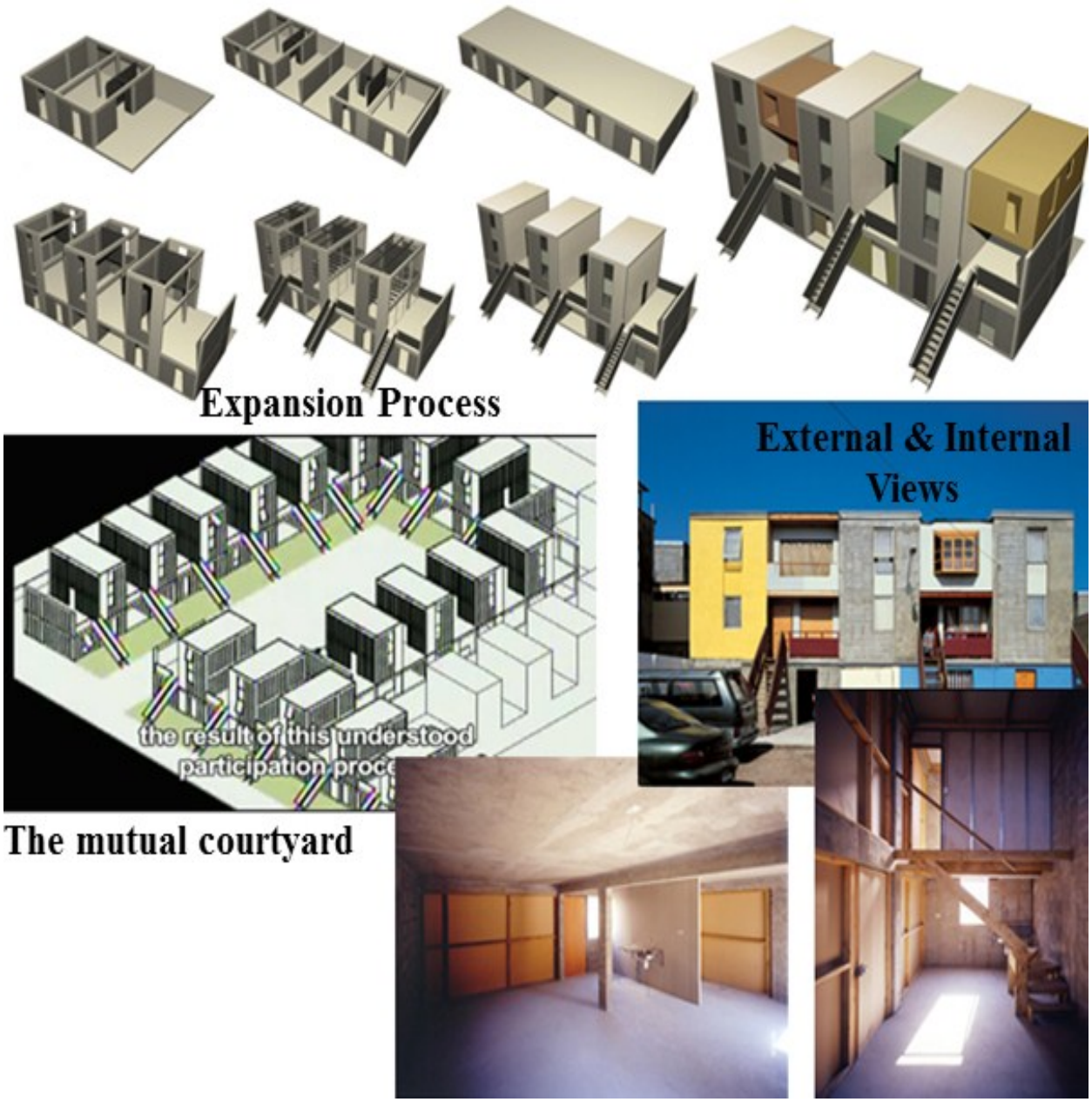


Figure 4.58 (continued) : Quinta Monroy Housing Concept (http:// www.moma.org/ interactives/ exhibitions & http://www.archdaily.com/).

- Case Study: Iquique (Chile): Barrio Chile's challenge: to accommodate one hundred families who had illegally occupied in 30 years period on a small parcel of land in the desert city of Iquique, for $7,500 each. The execution process lasted for 9 months to construct 3500 m^2 in 5000 m^2 site. Almost immediately after moving into the complex, residents started to expand their homes, using the architects' carefully determined openings and plans as guides (URL-27). The component of the system is shown is figure 4.59.

Figure 4.59 : Sketching Components of quinta monroy (http://www.archdaily.com /10775/quinta-monroy-elemental/).

The plans of the complex are shown in figure 4.60.

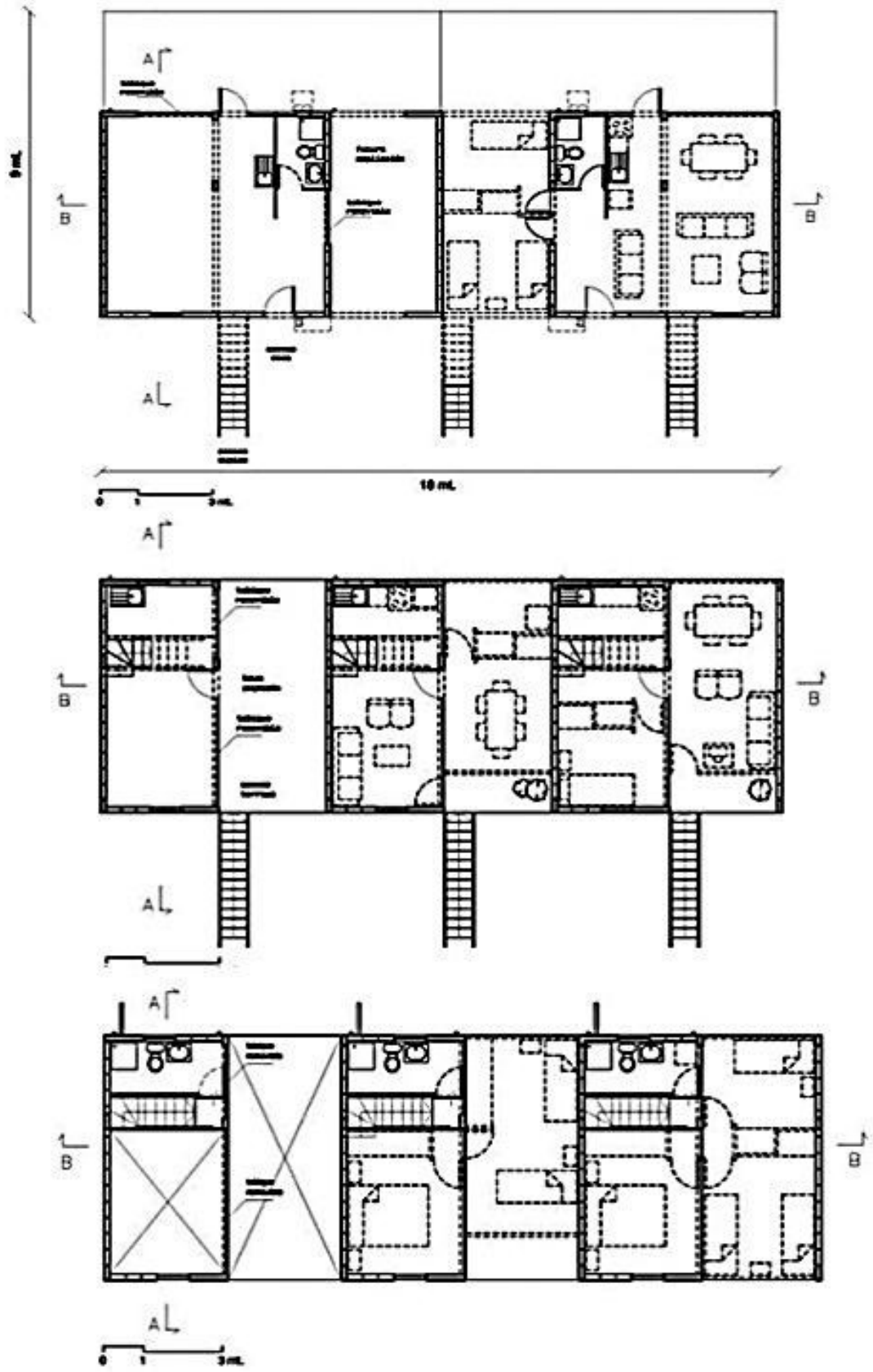


Figure 4.60 : The three-story building plans of quinta monroy (http://www. archdaily .com/10775/quinta-monroy-elemental/).

4.4.1.4 Structural insulated panels (SIP) prefabricated system – 1952

An introduction to this type of shelter is identified in four steps: Definition, Blocks systems, Specifications and Case study:

- Definition: U.S. Department of Agriculture has first developed structural Insulated Panels in 1947 and Alden B. Dow – son of the founder of DOW Chemical Company – designed SIPs for residential construction and built homes starting in 1952. SIPs have been found to be the safest modern building system for earthquake zones.

Structural insulated panels (SIPs) are high performance building panels used in construction of floors, walls, & roofs in residential & light commercial buildings (URL-28).

- Specifications:

A. *Shelter Function:* Permanent Shelter
B. *Users:* Natural Disastrous Victims
C. *Climate:* Various – The constructed insulation in the walls and roof make it compatible with hot and cold climates.
D. *Structural Components:*

Material – It may vary to the market - SIPs are a compound of a sandwich of two layers of sheets— OSB, plywood, steel, or fiber-cement —with an insulating layer of foam in between. The most common panels consist of OSB over EPS.

The concept of the system is shown in figures 4.61.

- Construction method:

- Preparing a concrete surface, screwing it to the deck and sealing the edges of the plate
- Standing the panels over the plate
- Nailing the panels to the plate
- Panels are connected edge-to-edge with splines

Figure 4.61 : Conceptual design and built prototype of SIP system (http://www. elementalchile.cl/viviendas/casa-elemental-tecnopanel/? lang_pref =en).

5. ASSESSMENT

The assessment is according to the concepts of the shelters. Shelters with the parallel idea will be evaluated with one another to see which idea is stronger in each emergency housing category and figure out the efficiencies and inefficiencies of each shelter type. Assessing factors encompass time and quality (architectural factors, environmental performance and comfort).

5.1 Assessing Factors

5.1.1 Time of construction

Time is a significant factor addressed by Chan (2006). According to Balyejjusa and Mitchell Stein, in the time of emergency response especially when the condition is so critical, emergency must firstly go to the most vulnerable community like old people, women and children. The most crutial items to affect constructing time are the work force and using available materials.

1. Self – Help: Rathi (2010) and Sloan (2009) consider *Economy* as the most important element in responding emergency and provide adequate on-time shelters. *Self-help* is a method for *promoting responsibility* and pleasure among the victims and reducing constructing time and money that can be considered as a main key for constructing shelter.
2. Transportation: Using vernacular materials would remove the cost of transportation and create a more identifiable building, besides in place (local) materials could help decrease constructing time.

5.1.2 Architectural aspects

For the architectural aspect the independent factors have been chosen shape and plan which are explained breifly below:

1. Shape: Familiar and pleasurable shape is of important features as well. Familiar shapes provide a better sense of belonging to the house and environment, so for each area, construction of the most popular house form is more logical.
2. Plan: The most controversial issue in creating emergency housing is to pay attention to the future growing of the shelter that should preferably be done by the user of the house. This is a big step to provide a sustainable and qualified shelter. In this respect, the expandability and flexibility of the plans are criteria of choosing a shelter.

5.1.3 Environmental performance

The three most effective factors of environmental performance item are introdunced below:

1. Recyclability: An important strategy for speeding reconstruction has been to design and build shelters using materials that can be repurposed for other purposes (Design Like You Give a Damn). This contains three groups of recyclable materials, made of recycled materials or recyclable shelters for more use. It is desirable that the shelter or its parts can be reused or recycled, because of low cost and better ecological effects.
2. Durability: A shelter is used in diverse climates ranging from cold to hot, dry, and moist. The shelter materials must withstand extreme temperatures and humidity.

It is also important that the shelter consists of solid materials, so that during transport, construction and especially use phases quality is guaranteed.

3. Insulation: To save energy, to avoid sound pollution and to accentuate durability of the shelter, it must be insulated against moisture, heat and sound.

5.1.4 Comfort

Comfort item in this thesis is divided into four more important factors explained below:

1. Ventilation:Ventilation is needed to prevent mold, and for a healthy indoor climate. If this is not the case, can diseases and infections are occurred at a high rate. The required ventilation is dependent on the climate. In a cold climate,

minimal ventilation is required to reduce heat loss. In a hot climate; however, maximum ventilation desirable to remove the heat as much as possible. The natural ventilation would lessen the cost and save energy.

2. Security: Internal security must be reliable to create a comfortable space.
3. Spaciousness: The spaciousness with the suitable space separation is the ideal demand of the users, so that they can devote separate areas for their various activities.
4. Privacy Gradient: Depending on the function of the shelters, the privacy expectation changes. The factors indicating the quality and duration of construction are shown in the table 5.1.

Table 5.1 : Scores of Comparing Factors

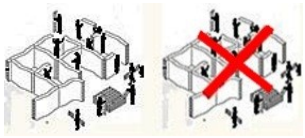
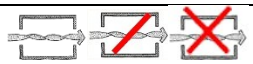
Scores of Comparing Factors				
Factors	**Sub-factors**	**Evaluating Shapes**	**Rating: 3= the highest, 1= the lowest**	**Max. Total Score**
1. Time of construction	**1.1 Construction Participatory**		**2-1**	**4**
	1.2 Transportation		**2-1**	
2. Architectural Aspects	**2.1 Shape = 3**		**3-2-1**	**12**
	2.2 Plan = 9	**2.2.1 Flexibility- Function** 	**3-2-1**	
		2.2.2 Flexibility- Furniture Layout 	**3-2-1**	
		2.2.3 Expandability 	**3-2-1**	

Table 5.1 (continued) : Scores of Comparing Factors

Factors	Sub-factors	Evaluating Shapes	Rating: 3= the highest, 1= the lowest	Max. Total Score
3. Environmental Performance	3.1 Recyclability Level =3		3-2-1	18
	3.2 Durability = 6	3.2.1 Climate 	3-2-1	
		3.2.2 Structural Resistance 	3-2-1	
	3.3 Insulation = 9	3.3.1 Acoustic 	3-2-1	
		3.3.2 Heat 	3-2-1	
		3.3.3 Humidity 	3-2-1	
4. Comfort	4.1 Ventilation		3-2-1	12
	4.2 Security		3-2-1	
	4.3 Spaciousness		3-2-1	
	4.4 Privacy Gradient		3-2-1	
Total				46

5.2 Assessment of the Emergency Shelters

5.2.1 Tents and paper shelters assessment

Main common concept: *The mutual idea of the two categories is to provide a fast deployable – transportable shelter that uses the minimum energy.* Therefore, they have all the properties of tents with some differences. Below, the evaluation of the tents and paper-shelters will be compared to emphasize the effective role of each category. Table 5.2 to 5.6 shows the assessment of each of emergency shelters.

Table 5.2 : Assessment of UNHCR tunnel tent.

ASSESSMENT	
1. Time of Construction	**1.1 Construction Participatory- Self-help**: It is easy to assemble with slight training. **1.2 Transportation** : Due to the lightweight design, transportation is performed with ease and reduced shipping cost
2. Architectural Aspects	**2.1 Shape:** Semi Circular-Tunnel Shaped
3. Environmental Performance	**3.1 Durability**: Depending on the climate that the tent is erected, the life-span is varied; it may be as long as 2 to 3 years Resistance to rain: accepting the extra slight increase in the weight Resistant to UV: The tent's synthetic plastic material is durable against UV degradation for 2.000 hours. Resistant to high degrees: the chimney made of special fire resistant fabric (apron) keeps the tent [of the probable fire events. **3.2 Insulation:** Anti-leak: the doubled-layer tent is stitched and seamed.
4. Comfort	**4.1 Ventilation:** 12 cm gap between the two layers of the tent provides a cooler temperature. Two front doors and two front windows equipped with mosquito net produce ventilation. **4.2 Spaciousness:** 4-5 people, Area: 5.5x3=16.50 m^2, central height: 2.10 m. **4.3 Privacy:** fabric partitions can be set up to create separate spaces and the two separate doors emphasize this privacy more.

Table 5.3 : Assessment of light weight emergency shelter.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help:** Since it is a monolith product, it can be erected swiftly. **1.2 Transportation:** Ease in transportation to disaster.
2. Architectural Aspects	**2.1 Shape:** An extended parabola **2.1 Flexibility:** Tents are more desired to be utilized for interim functions like emergency sheltering, camping relief aid and etc.
3. Environmental Performance	**3.1 Recyclability:** The materials are eco-friend. Being one-piece product, there will be no loose or lost pieces. **3.2 Durability:** Being a new patent, its stability is not yet liable. It can only be used in the first few days after a disaster. **3.3 Insulation:** It is suitable for various weathers.
4. Comfort	**4.1 Spaciousness:** 6-8 people

Table 5.4: Assessment of shelter frame kit.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help**: One can easily erect it in 15 minutes. **1.2 Transportation:** The lightweight tent consists of removable parts that can be detached and packed in a bag
2. Architectural Aspects	**2.1 Shape:** dome, The Frame Kit can be combined in various methods to create other shaped frames. The curved corners help to avoid weak points. **2.2 Flexibility:** It is found in different sizes, covered by various materials
3. Environmental Performance	**3.1 Recyclability:** The PVC frames can be used for irrigation pipes later. **3.2 Durability:** Dome shape accompanied with non-puncturing Grip Clips™ to covering in a strength enhancing manor to create the maximum strength for the materials used. "The ShelterFirst relief tent is a self-supporting tension structure" (URL-1). The covering made of multi-laminated woven rips top film is completely synthetic and will not rot or mildew and resilient to UV. **3.3 Insulation:** *The* shingled construction[3] *allows moist air to be driven out through the by vapor pressure* (URL-2).
4. Comfort	**4.1 Ventilation:** The gap among the overlapping layers makes the covering breathable. **4.2 Spaciousness:** 6-8 people, 7.4 x 3.4 x 2.6 m =269 m^2-25 ft^2 **4.3 Privacy:** The interior can be separated with fabric to create privacy.

Table 5.5 : Assessment of shelter 139.

ASSESSMENT	
1. Time of Construction	**1.1 Skilled Crew**: 12 people in 30 minutes can deploy it. **1.2 Transportation:** It can be unfolded and transported.
2. Architectural Aspects	**2.1 Shape:** Foldable- Umbrella Shaped, It is a privilege that let it to be collapsed for an easier transportation.
3. Comfort	**3.1 Ventilation:** The material reflects the sunlight and the aggregated central pint leads the warm weather out of the shelter. **3.2 Spaciousness:** 200 people, 5.382 ft^2 500 m^2

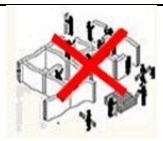
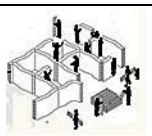
[3] A method for keeping the covering with grip clips without any punctuating which let the material to breath and air passing over the folded layers.

Table 5.6: Assessment of paper partition system.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help** **1.2 Transportation:** The parts can be provided by the reused papers around or can be transported to the place.
2. Architectural Aspects	**2.1 Shape:** various **2.2 Expandability:** They are modular patitiona that can be expanded.
3. Environmental Performance	**3.1 Recyclability:** They are made of reused materials; therefore, the process of scrap-and-build will be abolished. **3.2 Durability:** A few months **3.3 Insulation:** *The* shingled construction[4] *allows moist air to be driven out through the by vapor pressure* (URL-2).
4. Comfort	**4.1 Privacy:** The privacy can be applied by partitions made of paper tubes and canvas curtain.

In table 5.7 the tents and shelter papers are compared.

Table 5.7 : Tents and paper shelters assessment.

Factors	Sub-factor	Tents	Paper shelters
1. Time Score	**1.1 Construction Participatory**		
	1.2 Transportation		
2. Architectural Aspects Score	**2.1 Shape**		
	2.2 Plan		

[4] A method for keeping the covering with grip clips without any punctuating which let the material to breath and air passing over the folded layers.

Table 5.7 (continued) : Tents and paper shelters assessment.

Factors	Sub-factor	Tents	Paper shelters
3. Environmental Performance Score	3.1 Recyclability Level		
	3.2 Durability		
	3.3 Insulation		
4. Comfort Score	4.1 Ventilation		
	4.2 Security		
	4.3 Spaciousness		
	4.4 Privacy Gradient		

5.2.1.1 Time analysis

The prefabricated units of tents have high cost and time (production and transportation) and need trained crew in production phase and people just can help deploying with the crews' train. Tents are priorly designed shelters, whereas paper shelters are constructed in place with more freedom. The components of paper shelters are attached to each other with no joint, which highlights the simplistic approach of new shelter styles.

Time is a key consideration, tents and paper shelters can be disjointed or folded and packed in small boxes in a fracture of time, and due to their lightweight, transportation is undertaken readily and less costly. In figure 5.1 an example of prefabricated tents is shown.

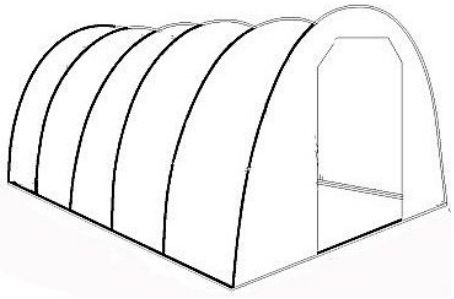


Figure 5.1: Prefabricated units make them more costly in tents (Personal image)

5.2.1.2 Architectural aspects analysis

Paper shelters can be set both separately and attacheable. The arrangement of blocks in row with low spaces among them is the main idea of Shigru Ben to increase community interaction.

To create a more secure community and sense of belonging it is logical to set the tents in clusters. It will also lead to the creation of courtyards in between the tents. Figure 5.2 indicates this creation of courtyards.

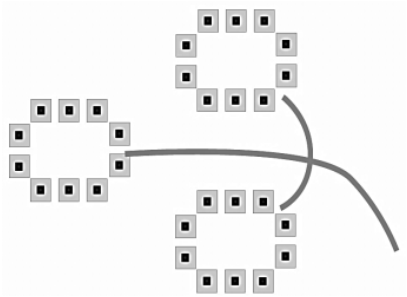


Figure 5.2: Arrangement of tents in clusters (United Nation, 2004).

For tents, a threshold is possible in non-floody zones by digging the terrain. Boxes used for transporting paper shelters play role of beds and thresholds for paper shelters in emergency. In figure 5.3 the method of furniture creation is shown.

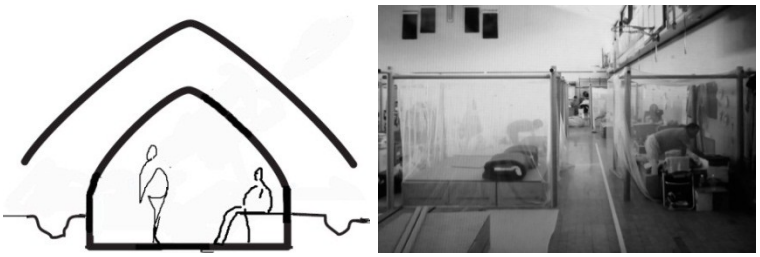


Figure 5.3 : Making interim furniture inside of tents and paper shelters (Personal image & http://www.designboom.com/weblog).

Tents are fixed with determined sizes made in factory that only have flexibility inside and cannot be expanded. Each accommodates five persons.

Instead of prefabricated units that limit flexibility and expandability, the paper shelters are made of modular sheets and joints that can be expanded in future.

The distance between two tents is 2 ½ times their height, which means a vast occupation of land. The paper partition shelters are first arranged in a line and the spaces are detached with acanvas partitions, which increase maximum use of area. Figure 5.4 represents the maximum use of land.

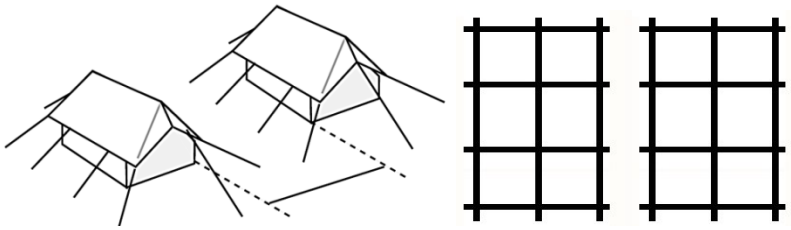


Figure 5.4 : Comparing Use of lands in tents and paper shelters (United Nation, 2004 and personal image).

5.2.1.3 Environmental performance analysis

1. Recyclability:

Definitely, paper is a recycable material. The paper shelters are made of recycled cardboard to avoid wasting money, energy and polluting environment. Although materials used for tents are recyclable, the procedure to produce new materials serves time and money. Ban replaced aluminum poles and cables with tube columns in paper shelters for more ease and strength. The materials are locally available that in the event of damage, there is a possibility to be repaired.

Tents cannot be furnished in every terrain. In steepy and rugged lands, it would be necessary to level and stabilize soil, but still is risky and increases the danger of flood. This difficulty is sketched in figure 5.5.

Figure 5.5 : Leveling the ground to erect the tents (Personal image).

In shelters with stiff materials such as cardboard connection to the surface is an issue.

2. Durability – Climates:

Tents cannot withstand cold and mountainous climates and there is a need to heater and insulation materials to save energy and money. They are inherently made for dry and hot weathers. Cardboards can easily withstand the hot weather and the canvas tents can be ventilated when needed.

3. Durability – Orientation:

Tents are not suitable for climates with permanent winds. If necessary, it would be wise to put them in contrast to common winds. As they are designed lightweight, they are vulnerable without a pole inside (see figure 5.6).

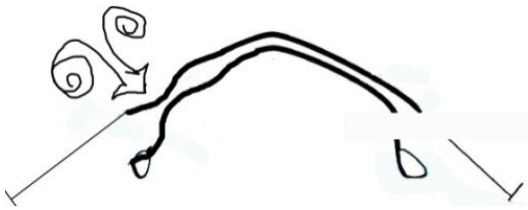


Figure 5.6 : Permanent prevailing wind makes problems in tents and paper shelters (Personal image).

Tube papers are laminated cardboards that increase strength and durability in pressure for paper shelters, but cardboard panels do not have that strength.

Materials are not of the most durable material, but fit well with the temporary nature of the shelter (life of 12 months). When laminated, paper tube shelters made of cardboards become more strengthened in comparison with only cardboard.

The pitched or arc shapes of the tents can easily lead the rain flow to lessen the pressure to the roof. Cardboards are resistant materials to rain but not to the sun. On the other hand, the house form design of the primitive tents makes them more desirable than the curved ones, whereas some may find the curved ones more creative and interesting (see figure 5.7).

Figure 5.7 : Roof Shapes guiding rain down (Personal image).

4. Insulation:

In cold weathers, the tents require a layer of insulation materials, unless they can withstand the chilly climates. Heat loss is shown in figure 5.8.

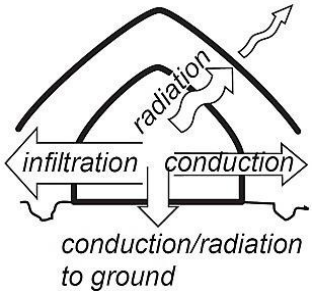


Figure 5.8 : Heat loss in tents (United Nation, 2004).

5.2.1.4 Comfort analysis

1. Comfort – Ventilation:

Using mosquito nets in hot weathers will alleviate cross ventilation (see figure 5.9).

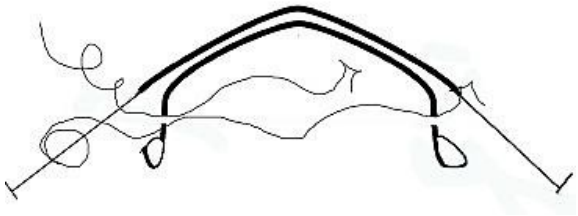


Figure 5.9 : Cross ventilation in tents (Personal image).

2. Social security:

It is highly recommended to make the camps like a village than a linear setting of tents. This will encourage the contribution of a sub-culture and social interaction, which highlight the social security. The suggested village form is made of small blocks each block is made of four units. Assumed block and the growing village type are shown in the figure 5.10.

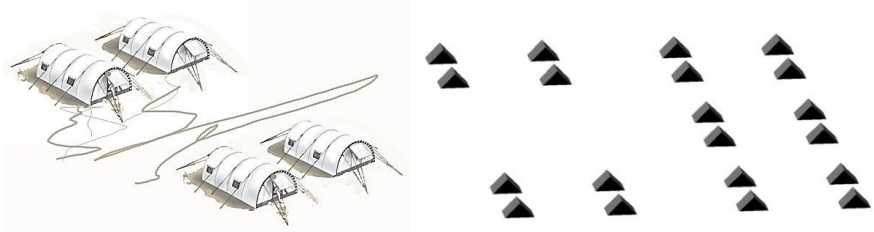


Figure 5.10 : Units block – units community of tents (Personal image).

3. Security:

To comouflague the tents of the probable post-disasters and attacks, it is logical to make walls out of the local materials such as mud and straw. The openings in the walls let the airflow. This natural ventilation is sketched in figure 5.11 below:

Figure 5.11 : Clay walls to make a more protected area in tents (Personal image).

4. Privacy gradient:

Spaces are arranged in a sequence, which corresponds to their degrees of privateness. Using cardboards instead of canvas increase the tensity of gradient in paper shelters. Figure 5.12 represents the privacy gradient of tents.

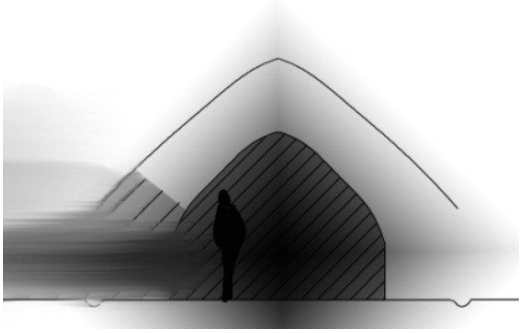


Figure 5.12 : Privacy gradient in tents (Personal image).

5. Interior privacy:

Although partions make separation among areas, still the separation does not provide a hundred percent privacy. The materials are not rigid and cannot control the acoustic. Even the shades of the persons are sign of existance of numbers of people inside. In paper shelters, the cardboard separating the spaces, is neither acousticaly reinforced nor sturdy enough to create a reliable place.

Following the concept: to provide a fast deployable – transportable shelter that uses the minimum energy. A brief look to the comparing table shows that paper shelters exceed tents in achieving this aim. They are constructed of the reused materials with

people help, so the energy, money and specially constructing time is lessened. The construction happens faster and the emergency term is truly qualified.

5.3 Assessment of the Temporary Housing

5.3.1 Temporary housing - group 1 assessment

This part is an assessment to first step housing or soft house, global village shelter (GVS) and primitive emergency shelter or portable examples of temporary housing group 1.

Main common concept: *To provide a transitional flexible shelter out of prefabricated structure for a maximum use of space.*

Table 5.8 to 5.10 shows the assessment of each of temporary housing group 1.

Table 5.8 : Assessment of first step housing.

ASSESSMENT	
1. Time of Construction	**1.1 Skilled Crew**: It is used of pre-fabricated pieces. **1.2 Transportation:** Transportation is possible with the vehicles.
2. Architectural Aspects	**2.1 Shape:** Cubicle. **2.2 Flexibility:** "Not only does the occupant affect their unit but also the corridor is always different based on the location and angle of each unit. If (hopefully) built, this shared space would become a lively, ever-change place, as soft and comforting as the units themselves" (URL-12). This design proposed a moveable partition and furniture system for transitional homeless shelters. **2.3 Expandability:** The whole components are foldable to make maximum use of the space.
3. Environmental Performance	**3.1 Recyclability:** They can be folded and reused later. The materials are environmentally sustainable. **3.2 Durability:** Affordable dwelling units for 21-day period of stay that can be increased. **3.3 Insulation:** It has a sound absorption design.
4. Comfort	**4.1 Ventilation:** The light and the air going through the transparent shelter walls brighten and ventilate the corridor. **4.2 Spaciousness:** 60 ft^2 - 5.6 m^2 **4.2 Privacy:** The users can set the gradient of the privacy themselves. It is easily personalized.

Table 5.9 : Assessment of GVS.

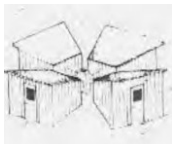
ASSESSMENT	
1. Time of Construction	**1.1 Self-help**: It is one-piece structure that two people can put one together in 15 minutes. **1.2 Transportation:** It is so lightweight Prefabricated houses that can be easily transported and erected.
2. Architectural Aspects	**2.1 Shape:** Rectangular **2.3 Flexibility:** The modular pieces generates limitation in architecture.
3. Environmental Performance	**3.1 Recyclability:** It is made of recyclable polyester mesh and aluminum, so it can be reused or recycled when the emergency is over. **3.2 Durability:** The life span: 8-12 months, They are wind- resistant and fire-resistant folding houses. **3.3 Insulation:** The triple cardboard walls are coated with weather proof materials.
4. Comfort	**4.1 Spaciousness:** 8-10 persons, 65 ft^2

Table 5.10 : Assessment of portable shelter.

ASSESSMENT	
1. Time of Construction	**1.1 Skilled Crew**: It is made of pre-fabricated pieces. **1.2 Transportation:** The parts should be carried to the site.
2. Architectural Aspects	**2.1 Shape:** Four separate shelters that are grouped around a common shared heating system in between. **2.2 Flexibility:** The four parts of each block can be organized to prepare a single-family house later. **2.3 Expandability:** Multiple pieces can be attached for more space making.
3. Environmental Performance	**3.1 Recyclability:** The deployed prototypes for four families can later be used to design a single-family house. **3.2 Durability:** Based on the materials used for the structure and the covering, stability of the shelter changes.
4. Comfort	**4.1 Spaciousness:** Four families **4.2 Privacy:** Every family has a separate door not facing each other.

In table 5.11 below temporary shelters group 1 are compared.

Table 5.11: Temporary housing – group 1 assessment.

Factors	Sub-factor	Soft House	GVS	Portable
				
1. Time Score	1.1 Construction Participatory			
	1.2 Transportation			
2. Architectural Aspects Score	2.1 Shape			
	2.2 Plan	  	  	 
3. Environmental Performance Score	3.1 Recyclability Level			
	3.2 Durability	 	 	 
	3.3 Insulation	  	  	  
4. Comfort Score	4.1 Ventilation			
	4.2 Security			
	4.3 Spaciousness			
	4.4 Privacy Gradient			

Considering the results of this table with the specified scores the following graphs can be drawn up, shown in 5.13 figure.

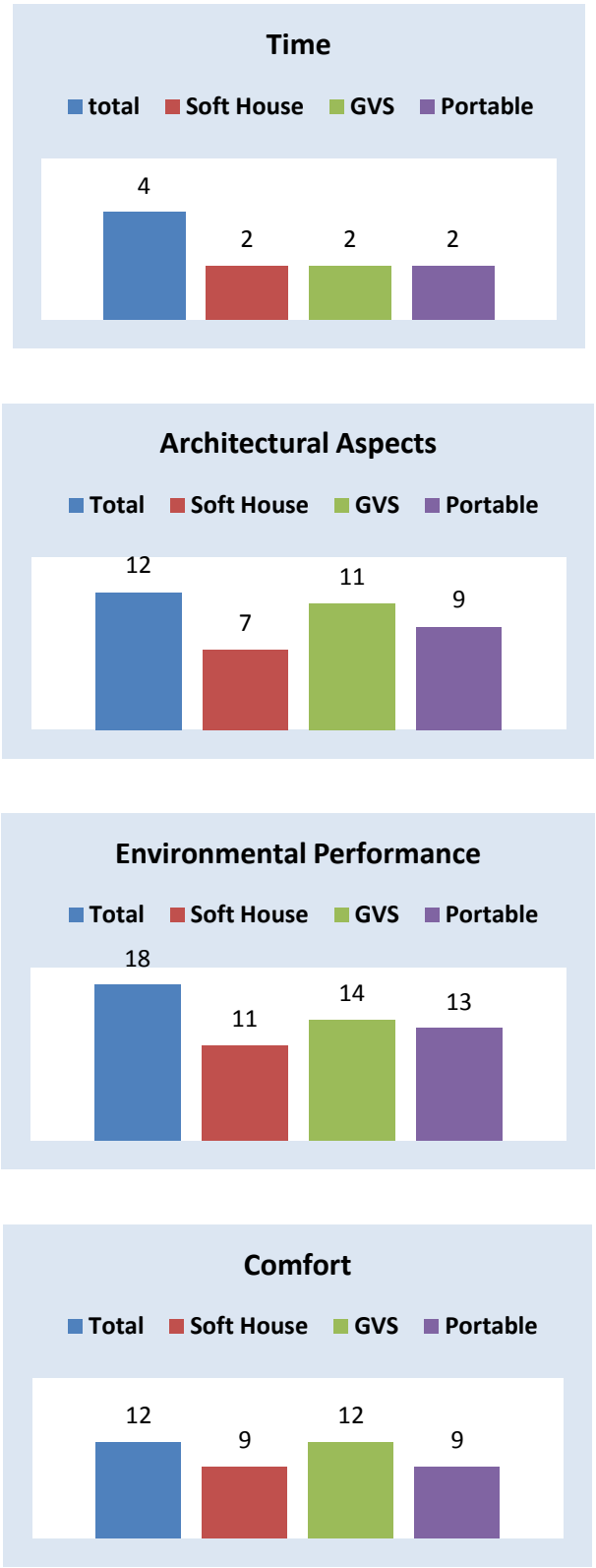


Figure 5.13 : Graphs showing quality and time of construction of temporary housing group 1.

5.3.1.1 Time analysis

The common problem among the three examples is that they are all complicated systems to deploy. Using local low-cost material and local labour in a temporary housing are of great importance to save time and money that have been neglected in all three shelters schemes as shown in the figure above. The designer has focused on pre-fabrication and shipment, and neglect readily available local labour and raw materials. All are compound of prefabricated components that will be deployed at site. Therefore, the transportation cost will remain.

5.3.1.2 Architectural aspects analysis

Defining as a prefabricated unit Soft House has the capacity to change inside and outside spaces. Not only the unit performance changes due to the flexible modifications, but also the components' behaviour is changeable. The components are also the furniture of the shelter. A wall can be converted into a table or a bed. This flexibility dictates the optimized consumption of land. As if it is not a very common form, but the creatibe idea is very attractive. Primitive Emergency Shelters and GVS are prepared as one-story units that are attached to one another to make a multi-family or single-family building. Although expandibility is possible using modular units, the space is not flexible and is prescribed formerly. The only flexibility is for the function of the units that depending on the need of the society, they can be used for other purposes as well. Soft house units somehow fullfil the need for flexibility.

5.3.1.3 Environmental performance analysis

The stability of the three shelters is not %100 reliable yet and need to be tested. The cease of Primitive Emergency Shelters production in its time shows the failure of the system as a multi-family construction for social camp. To overcome the various effects of the climate, the shelter materials should withstand the extreme humidity and temperature, which are unclear factors in these shelter types. As seen in the picture GVS has the less effect of the Eco-system that can tolerate the adverse disasters much better than the two others can.

5.3.1.4 Comfort analysis

The community made of the complex settlement in Primitive Emergency Shelters has extreme privacy with a weak connectivity, which is created by the mutual heater among the four units, whereas in the soft house, the concentration point is to turn the hallway into a public share space and the privacy is achieved by the occupant's desire. Among the shelters, GVS can hold more persons and is too roomy that is more pleasurable.

As a result, from the view of quality, Globle Village house is more preferable. It approximately provides expected needs and desires by far much than the other two types. Since the three examples have to be built by experts monitoring, the construction time lasts longer, so they do not totally highlight emergency.

5.3.2 Temporary housing - group 2 assessment

This part is an assessment to concrete canvas shelters (CCSs), next- gen dome, inter shelter domes – dome village and hexayurt examples of temporary housing group 2.

Main common concept: *Affordable temporary housing with the benefits of permanent housing.* Table 5.12 to 5.14 shows the assessment of each of temporary housing group 2.

Table 5.12 : Assessment of CCS.

	ASSESSMENT
1. Time of Construction	**1.1 Self-help**: Only water and air is needed to assemble the shelter. 2 people can deploy the shelter within 2 hours with no training. The shelter is then read to use in 24 hours. **1.2 Transportation:** With vehicles
2. Architectural Aspects	**2.1 Shape:** Dome **2.3 Flexibility:** It is only found in 2 different sizes: CCS25 and CCS54 (with 25sqm and 54sqm of floor space respectively).
3. Environmental Performance	**3.1 Recyclability:** It is used of recyclable materials. **3.2 Durability:** This type of shelter can live over 10 years which is by far much than tents' stability. **3.3 Insulation:** A thin concrete layer insulates the dome of water and fire The shelter cortex can be coated by sand or earth (berming) to offer insulation and besides protection in the front line.
4. Comfort	**4.1 Ventilation:** The canopy shading the roof makes the internal part of the shelter cooled off.. **4.2 Spaciousness:** 270 ft^2 - 109 m^2.

Table 5.13 : Assessment of dome village.

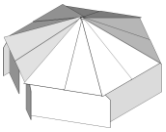
ASSESSMENT	
1. Time of Construction	**1.1 Self-help**: They can be assembled in four hours with two people. **1.2 Transportation:** With vehicles
2. Architectural Aspects	**2.1 Shape:** Dome
3. Environmental Performance	**3.1 Recyclability:** can be disassembled in 45 minutes and reused. **3.2 Durability:** Life expectancy of over 30 years
4. Comfort	**4.1Security:** Safe – approved by state and federal agencies for housing

Table 5.14 : Assessment of Hexayurt.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help**: Participatory in deploying the shelter give the victims sense of dignity and esteem. It can be erected by 5 people within 45 minutes **1.2 Transportation:** Cardboard like Hexacomb gives cheap, shippable houses.
2. Architectural Aspects	**2.1 Shape:** Dome, geodesic- semi-folding yurt, The hexagon is a naturally stable form and excellent for construction and durable in pressure. **2.2 Expandability:** It is designed in various sizes and built in various manners. It can be expanded by attaching hexas next to each other.
3. Environmental Performance	**3.1 Recyclability:** The used materials can be recycled and have no harm for the environment. **3.2 Durability:** Plywood Hexayurts can survive for three years. **3.3 Insulation:** In a cold weather, insulation is required for the cardboard.
4. Comfort	**4.1 Ventilation:** The canopy shading the roof makes the internal part of the shelter cooled off. The intrinsic behavior of this shape is to keep the interior 10-15 degrees cooler than the exterior part. **4.2 Spaciousness:** 5 persons, 161 ft2 / 15 m2, It is incredibly roomy. **4.3 Privacy:** By dividing the area with partitions, one can create privacy in the shelter.

In table 5.15 temporary housing group 2 are compared.

Table 5.15 : Temporary housing – group 2 assessment.

Factors	Sub-factor	CCSs	Dome Village	Hexayurt
				
1. Time Score	1.1 Construction Participatory			
	1.2 Transportation			
2. Architectural Aspects Score	2.1 Shape			
				
	2.2 Plan			
				
3. Environmental Performance Score	3.1 Recyclability Level			
	3.2 Durability			
				
	3.3 Insulation			
				
4. Comfort Score	4.1 Ventilation			
	4.2 Security			
	4.3 Spaciousness			
	4.4 Privacy Gradient			

Considering the results of this table with the specified scores the following graphs can be drawn up, shown in 5.14 figure.

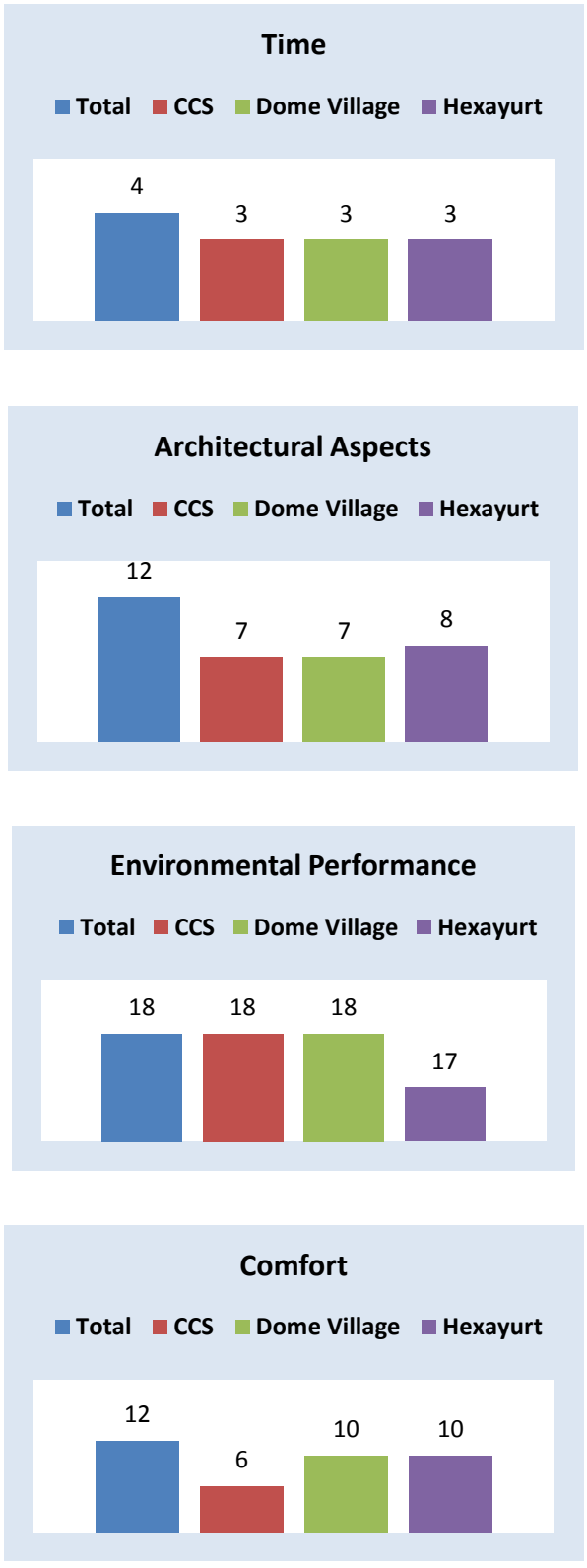


Figure 5.14: Graphs showing quality and time of construction of temporary housing group 2.

5.3.2.1 Time analysis

Temporary housing is not referring to that much emergency as emergency shelters. With respect to their function as temporary houses, the time needed to build them shows that there is a delay that is accepted. This gap creates the opportunity to build a more qualified shelter, which is equal among the three samples.

5.3.2.2 Architectural aspects analysis

Depending on the traditional buildings of each zone, the shape of the houses changes. Yet actually all the three examples are not frequently used shapes in the world and people have not yet accept them as their houses and may have no sense of belonging and always considering them as an interim place. In dome village and CCS, for the sake of round plan, the furniture would create useless spaces, which is waste of interior space. In Hexayurt, the corners solve this problem.

5.3.2.3 Environmental performance analysis

They are supposed to be temporary but they can withstand for over 30 years so they are trustable from the view of stability. Dome is a sustainable shape and the monolithic nature of the concrete makes it sturdier, whereas Hexayurt with paper foldable corners has vulnerable points in comparison with monolithic domes. This feature also makes the domes less permeable. Concrete is a material with high thermal mass that can reduce energy use in a high amount.

5.3.2.4 Comfort analysis

In sunny and hot days, the dome shape of the shelters let the shelter be half in shade and half in sun, which generates airflow inside the shelter and causes natural ventilation. Due to the firm shape and structure of the shelters, the whole examples are intensly secured. Internal space separation in domes and hexayut is a bit difficult due to its shape. Especially in Hexayut due to the angles, the separation should begin from the corners, which does not create pleasing spaces and cannot solve the privacy problem inside.

5.4 Temporary Housing that Can Be Converted to Permanent Housing Assessment

5.4.1 Temporary housing that can be converted to permanent – group 1:

This part is an assessment to core housing, transitional community (T-shelter) and pallet house.

MUTUAL CONCEPT: *Self-help incremental housing, they are all used to be 'growing' houses.* Table 5.16 to 5.18 shows the assessment of each of temporary housing that can be converted to permanent group 1.

Table 5.16 : Assessment of Core Housing.

	ASSESSMENT
1. Time of Construction	**1.1 Self-help**: It is made of prefabricated parts that can be erected with the help of local laborers in few hours. **1.2 Transportation:** It is possible via vehicle.
2. Architectural Aspects	**2.1 Shape:** Rectangular **2.2 Expandability:** The first built houses are small with the capacity to be expanded later, both vertically and horizontally.
3. Environmental Performance	**3.1 Recyclability:** Recyclability depends on the choice of the materials. **3.2 Durability:** It depends on the stability and kind of materials. **3.3 Insulation** Unlike its low thickness, the composite structural materials make the shelter, fireproof, waterproof and mold-proof.
4. Comfort	**4.1 Ventilation:** Screened windows are embedded in the shelter to produce air circulation. The sides are open to let the fresh air in and make the house ventilated. **4.2 Spaciousness:** 8 persons, 20 ft^2, over eight feet in height

Table 5.17 : Assessment of transitional community.

	ASSESSMENT
1. Time of Construction	**1.1 Self-help**: 12 people can deploy the shelter in 30 minutes. **1.2 Transportation:** It is possible via vehicle.
2. Architectural Aspects	**2.1 Shape:** Rectangular **2.2 Flexibility:** The shelter design leads to many different shelter proposals
3. Environmental Performance	**3.1 Recyclability:** In disaster recovery, for shipping aids like clothing, the pallets used for the shelter ground can be reused. **3.2 Durability:** They can be dismantled after a year. **3.3 Insulation:** Its frame is galvanized.

Table 5.17 (continued) : Assessment of transitional community.

4. Comfort	**4.1 Ventilation:** To reduce the sun heat, the walls have been doubled forming a ventilated air hollow. **4.2 Spaciousness:** 18.6m^2 - 200 ft^2 **4.3 Privacy:** Due to the small area, not enough space can be devoted for the family members.

Table 5.18 : Assessment of pallet house.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help**: *The shelters can be built by hand at a rate of 500-600 pallets per day* (URL-17). **1.2 Transportation:** One can build it via accessible plywoods
2. Architectural Aspects	**2.1 Shape:** Rectangular **2.3 Expandability:** It can be expanded and create various shapes.
3. Environmental Performance	**3.1 Recyclability:** The materials can be recycled and used later or the building itself can be produced of recycled materials. **3.2 Durability:** It is erected over a container which is a reliable foundation. **3.3 Insulation:** Adobe insulation: "Local materials can be used to finish the building like straw for insulation and cob or plywood for the exterior sheathing" (URL-18).
4. Comfort	**4.1 Ventilation:** Cross Ventilation **4.2 Spaciousness:** 8-10 persons, 1.200 ft^2 - 110 m^2 **4.3 Privacy:** 2 bedrooms

In table 5.19 temporary housing that can be converted to permanent group 1 are compared.

Table 5.19 : Temporary housing that can be converted to permanent – group 1 assessment.

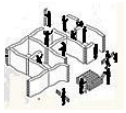
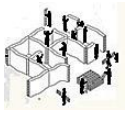
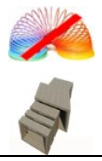
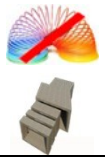
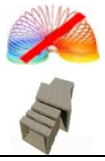
Factors	**Sub-factor**	**Core Housing**	**T-Shelter**	**Pallet House**
				
1. Time Score	**1.1 Construction Participatory**			
	1.2 Transportation			

Table 5.19 (continued) : Temporary housing that can be converted to permanent – group 1 assessment

Factors	Sub-factor	Core Housing	T-Shelter	Pallet House
				
2. Architectural Aspects Score	2.1 Shape			
	2.2 Plan			
3. Environmental Performance Score	3.1 Recyclability Level			
	3.2 Durability			
	3.3 Insulation			
4. Comfort Score	4.1 Ventilation			
	4.2 Security			
	4.3 Spaciousness			
	4.4 Privacy Gradient			

5.4.1.1 Architectural aspects analysis

The three examples lead to a new term of “incremental or growing building”. As building is not yet finished when it is completed; people can use their imagination and recreate their life in the residence. This puts the building to the expansion phase. They are expanded when needed by the owners.

Since they build the house themselves, they are more satisfied with it and feel more belonging to the environment and shelter. Architects to avoid feasible mistakes should monitor the construction process.

In addition, it would be better if the building were constructed with standardization and modular system. Core house is furnished by bunk style beds and Pallet house's attic is an extra sleeping bed for a more flexible plan.

5.4.1.2 Environmental performance analysis

The core house is made of prefabricated composite materials harmful for the ecology, and it intensifies the cost of the construction. However, the two others are made of recycled local materials, which accentuate their negligible effect on the environment.

Following the concept: The whole analysis shows slight difference among the examples and depending to the conditions, each of these shelters can be deployed. Score of each is so close to the ideal. The concept is well established in all of the examples.

5.4.2 Temporary housing that can be converted to permanent – group 2 assessment

This part is an assessment to Superadobe, sand bag shelter, eco-dome; rubble house and paper log houses.

MUTUAL CONCEPT: *Affordable eco shelters to prove self-built shelter.*

Table 5.20 to 5.22 shows the assessment of each of temporary housing that can be converted to permanent group 2.

Table 5.20 : Assessment of superadobe.

	ASSESSMENT
1. Time of Construction	**1.1 Self-help**: With a minimum of training, the occupants can build it easily in a few weeks. **1.2 Transportation:** In place
2. Architectural Aspects	**2.1 Shape:** Dome, The vaults inside makes the building remarkable. **2.2 Expandability:** The scale of structures and arrangement of clusters can be varied. *The house can be easily extended by adding circular dome elements to the original form* (URL-21).

Table 5.20 (continued) : Assessment of superadobe.

3. Environmental Performance	**3.1 Recyclability:** It can be later be used as a permanent housing. **3.2 Durability:** - Earthquake resistant: The addition of barbed wire to the compression structures creates earthquake resistance. - Flood resistant: the use of sandbags aids flood resistance - Fireproof: the earth itself provides insulation and fireproofing. - Hurricane resistant: the aerodynamic form resists hurricanes. **3.3 Insulation:** The earth itself behaves like insulation.
4. Comfort	**4.1 Ventilation:** Dome shape structure with a hollow in the center of roof provides air ventilation in the shelter. **4.2 Spaciousness:** 50 ft^2 - 4.6 m^2 **4.3 Privacy:** They can be attached to each other to provide more rooms.

Table 5.21: Assessment of rubble house.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help:** With the help of local civil community this modular system can be propagated in 2-3 weeks, minimizing the cost 40% to 50% less than prefabricated concrete or steel-insulated units. **1.2 Transportation:** The system bypasses the transportation difficulties and is constructed in place.
2. Architectural Aspects	**2.1 Shape:** Rectangular
3. Environmental Performance	**3.1 Recyclability:** *The units can later be dismantled for use in the rehabilitation of old quarries, riverbanks, as retaining walls or bridge embankments* (URL-24). The houses can be later used for other purposes like clinic or schools. From the remains of a 150m^2 house, a 78m^2 house can be built. **3.2 Durability:** The crates cannot be threatened by water and are durable; in the space between the paper tubes, self-adhesive waterproof sponge tape was applied to both sides. **3.3 Insulation:** The sand filled beer crates are used as a foundation with a plastic covering to keep the shelter insulated of water penetrating.
4. Comfort	**4.1 Privacy:** Gypsum is used for internal space subdivision.

Table 5.22 : Assessment of paper log house.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help:** It can be built by everyone on site. **1.2 Transportation:** In place
2. Architectural Aspects	**2.1 Shape:** Rectangular **2.2 Expandability:** .8m space between houses was used as a common area.
3. Environmental Performance	**3.1 Recyclability:** The cardboards can be reused. **3.2 Durability:** The crates cannot be threatened by water and are durable; in the space between the paper tubes, self-adhesive waterproof sponge tape was applied to both sides. **3.3 Insulation:** The sand filled beer crates are used as a foundation with a plastic covering to keep the shelter insulated of water penetrating.
4. Comfort	**4.1 Ventilation:** By keeping wall and the ceiling separated pleasant ventilation is flown to the interior part; and again in winter they are attached to keep the house warm. **4.2 Spaciousness:** 5 persons, 52 m^2 - 560 ft^2.

In table 5.23 temporary housing that can be converted to permanent group 2 are compared.

Table 5.23 : Temporary housing that can be converted to permanent – group 2 assessment.

Factors	Sub-factor	Superadobe	Rubble House	Paper Log
				
1. Time Score	**1.1 Construction Participatory**			
	1.2 Transportation			
2. Architectural Aspects Score	**2.1 Shape**			
				
	2.2 Plan			
				

Table 5.23 (continued) : Temporary housing that can be converted to permanent – group 2 assessment.

Factors	Sub-factor	Superadobe	Rubble House	Paper Log
				
3. Environmental Performance Score	3.1 Recyclability Level			
	3.2 Durability			
	3.3 Insulation			
4. Comfort Score	4.1 Ventilation			
	4.2 Security			
	4.3 Spaciousness			
	4.4 Privacy Gradient			

5.4.2.1 Time Analysis

The components in the paper log can be segregated and transported to the zone, whereas in Eco-Dome and Rubble House are made of local materials. The tube papers of Paper Log shelter framework are fabricated materials, which mean use of time, energy and money. Using barbed wire instead of aluminum makes the Eco-Domes less expensive than Rubble House.

5.4.2.2 Architectural aspects analysis

The vaults in Eco-Dome and corrugated façade of the Paper Log house make them visually unique.

5.4.2.3 Environmental performance analysis

They all use recycable materials to have the minimum impact on the environment.

The materials are either vernacular like in Eco-Dome and Rubble House or readily available like cardboard. Clay and concrete unlike paper have a great thermal mass that can reduce the energy use to minimum.

5.4.2.4 Comfort analysis

Dome shape structure with a hollow in the center of roof provides air ventilation in the shelter.

Following the concept: All of the examples are made of the cheapest recyclable materials which only need local force to achieve the desire of money saving. Locality of the building improves the desire of staying longer in the buildings. The analysis shows the maximum life standards with the minimum cost.

5.4.3 Temporary housing that can be converted to permanent – group 3 assessment

This part is an assessment to Safe [R] house, aero house (AH) and monolithic eco-shells.

MUTUAL CONCEPT: *low-tech construction, high-tech design.* Table 5.24 to 5.26 shows the assessment of each of shelter (group 3).

Table 5.24 : Assessment of safe r house.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help** **1.2 Transportation:** In place
2. Architectural Aspects	**2.1 Shape:** Rectangular **2.2 Expandability:** The site is the same as existing coastal houses. Expansion in size is possible, using modular system.
3. Environmental Performance	**3.1 Recyclability:** Partitions are made of bamboo that are recycled elements. **3.2 Durability:** A sturdy roof: To strengthen the four cores, the top of the cores are restrained by the anchored primary members. Tsunami resistant: This shelter can withstand tsunami waves 10% more than conventional houses. Rain and sunlight resilient: it has a pitched roof that is coated with vernacular materials like tile or tin make it suitable for avoiding rain. **3.3 Insulation:** The roof coats of clay, convert it to a better thermal insulator.

Table 5.24 (continued) : Assessment of safe r house.

4. Comfort	**4.1 Ventilation:** The lightweight bamboo partitions create a porous and ventilated skin, improving internal comfort. **4.2 Spaciousness:** 4 people, 50 m^2, cores has a dimension of 1.2m x 3.2m **4.3 Privacy:** The spaces can be separated.

Table 5.25 : Assessment of aero house.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help**: Due to the use of modular pieces, a single module (20-by-8-foot wooden box that is ten feet high) can be assembled by 6 people in 2 days, avoiding construction waste that reduces cost. **1.2 Transportation:** solid structure that can be transported easily in 2 days.
2. Architectural Aspects	**2.1 Shape:** Modular cubic box. **2.2 Flexibility:** - The height is also changeable by adding or removing floors. - Balconies can even be added to the housing system. - Moreover, the columns are flexible in size; one can grow the columns to create a parking pilot. **2.3 Expandability:** For an entire house, more modules and site is required. The wooden units can be expanded and relocated. It is free to change the size, based on life style and usage.
3. Environmental Performance	**3.1 Recyclability:** AH can be used as a small library, clinic or gallery after the families leave. "The entire building can easily be transported to the new site, bypassing the wasteful "scrap-and-build" mentality that is common in Japan" (URL-23). **3.2 Durability:** - Earthquake resistant: The addition of barbed wire to the compression structures creates earthquake resistance. - Flood resistant: the use of sandbags aids flood resistance. - Fireproof: the earth itself provides insulation and fireproofing. - Hurricane resistant: the aerodynamic form resists hurricanes. **3.3 Insulation:** A naturally planted roof insulates the shelter and reduces energy loss.
4. Comfort	**4.1 Spaciousness:** 16.5 m^2, having no columns inside, make the space wider and comfortable.

Table 5.26 : Assessment of monolithic eco-shell.

ASSESSMENT	
1. Time of Construction	**1.1 Self-help**: They can be built by native labor in 3 days. **1.2 Transportation:** It is possible via vehicle.
2. Architectural Aspects	**2.1 Shape:** Dome- Hemisphere **2.2 Flexibility:** *The curved surfaces result in oddly shaped rooms when divided up, which can result in wasted space in narrow corners*(URL-19).
3. Environmental Performance	**3.1 Recyclability:** Unlike that of a Monolithic Dome, the EcoShell's airform is removed and reused (URL-20). **3.2 Durability:** Virtually, domes are strong structures. The aerodynamic shape of the structure makes it resistant to the windy weather. Snow and water inflict relatively little stress on the exterior of a dome since its shape sheds water quickly.
4. Comfort	**4.2 Spaciousness:** 300 ft^2 or 28 m^2

In table 5.27 temporary housing that can be converted to permanent group 3 are compared.

Table 5.27 : Temporary housing that can be converted to permanent – group 3 assessment.

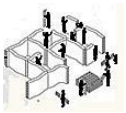
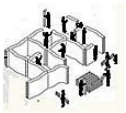
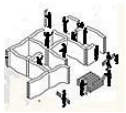
Factors	Sub-factor	Safe r House	Aero House	Monolithic Eco-shell
				
1. Time Score	**1.1 Construction Participatory**			
	1.2 Transportation			
2. Architectural Aspects Score	**2.1 Shape**			
				
	2.2 Plan			
				

Table 5.27 (continued) : Temporary housing that can be converted to permanent – group 3 assessment.

Factors	Sub-factor	Safe r House	Aero House	Monolithic Eco-shell
				
3. Environmental Performance Score	3.1 Recyclability Level			
	3.2 Durability			
	3.3 Insulation			
4. Comfort Score	4.1 Ventilation			
	4.2 Security			
	4.3 Spaciousness			
	4.4 Privacy Gradient			

5.4.3.1 Architectural aspects analysis

Eco-shells, AH and Safe R House all are empty of columns which means more interior flexibility. The furniture is integrated with the shell in AH that keeps the shelter of the probable collapse of the furnitures.

5.4.3.2 Environmental performance analysis

Aero house is more resistent to earthquake, Safe R House to Hurricane and Monolithic Eco-Shell is resilient to the most of the disasters and is identified as the most trustable shape and structure, that is experienced in Iraq war. Since eco-shells are not insulated, for high temperate climates, we must forego the idea of EcoShell.

5.4.3.3 Comfort analysis

In AH privacy can be expanded both horizontally and vertically.

5.5 Permanent Housing Assessment

5.5.1 Monolithic dome, sistema arde, quinta monory and SIP assessment

Mutual Concept: *Creating Low-cost durable housing with humanized façade and interior and allow for the eventual expansion of the dwellings*. Table 5.28 to 5.30 shows the assessment of each of permanent housing.

Table 5.28 : Assessment of Monolithic Dome.

	ASSESSMENT
1. Time of Construction	**1.1 Skilled Crew**
2. Architectural Aspects	**2.1 Shape:** Rectangular **2.2 Flexibility:** Oddly divided room with difficulty in setting the furnitres.
3. Environmental Performance	**3.1 Durability:** Due to its shape the stress of snow and rain loads is reduced and allows winds to pass around it. They cannot be burned, eaten by bugs or destroyed by mold and will last for centuries and generations. **3.2 Insulation:** It is insulated in the outer layer.
4. Comfort	**4.1 Ventilation:** Its insulation is on the outside – doubling its effectiveness in different weathers

Table 5.29 : Assessment of Quinta Montoy housing.

	ASSESSMENT
1. Architectural Aspects	**1.1 Flexibility – Expandability:** *The settlement is grouped into dense clusters of twenty to thirty houses, creating communal courtyards and social space outside of each dwelling.* To solve the architecture limitation, houses in this project have the capacity to be expanded over time. - Initial house: 36m² - Expanded house: 70m² - Initial duplex: 25m² - Expanded duplex: 72m²
2. Environmental Performance	**2.1 Durability:** It has a reinforced structure stabilized for seismic durability.
3. Comfort	**3.1 Spaciousness**: - Rather than one family inhabiting in a single three-story building. - Land: 5.025m², Initial house: 36m² Units are divided into ground-floor units and upper-floor duplexes.

Table 5.30 : Assessment of SIP.

ASSESSMENT	
1. Time of Construction	**1.1 Skilled Crew:** Three people can assemble it in 2 days. There would be minimum job-site and wasted material by using pre-fabricated pieces. In compared with traditional wood panel construction, SIPs are more expensive. However, the savings it provides outweigh the costs to many owners of SIP buildings (URL-28). **1.2 Transportation:** In 30 days, it can be delivered.
2. Architectural Aspects	**2.1 Shape:** Rectangular **2.2 Flexibility:** Oddly divided room with difficulty in setting the furnitres.
3. Environmental Performance	**3.1 Recycability:** The small parts of the pieces are reused by the fabricator when tiny panels are needed **3.2 Durability:** This product can withstand 200 mile per hour winds in hurricane prone areas. **3.3 Insulation:** It is insulated in the outer layer. .

Table 5.31 : Permanent housing: monolithic dome, sistema arde, quinta monory and SIP assessment.

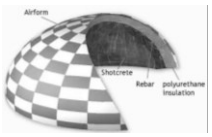
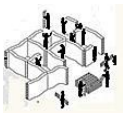
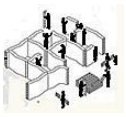
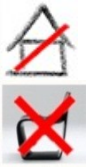
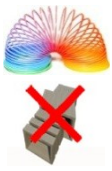
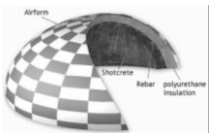
Factors	Sub-factor	Monolithic Dome	Sistema Arde	Quinta Monroy	SIP
					
1. Time Score	**1.1 Construction Participatory**				
	1.2 Transportation				
2. Architectural Aspects Score	**2.1 Shape**				
	2.2 Plan				

Table 5.31 (continued) : Permanent housing: monolithic dome, sistema arde, quinta monory and SIP assessment.

Factors	Sub-factor	Monolithic Dome	Sistema Arde	Quinta Monroy	SIP
					
3. Environmental Performance Score	3.1 Recyclability Level				
	3.2 Durability				
	3.3 Insulation				
4. Comfort Score	4.1 Ventilation				
	4.2 Security				
	4.3 Spaciousness				
	4.4 Privacy Gradient				

The effects of the factors changes according to the function of the shelter, for an emergency shelter, time is the most important criteria whereas in a temporary housing comfort and eco-effects play the crucial role; and in the permanent housing the quality is of the great significance.

5.5.1.1 Time analysis

The construction of the monolithic domes is a new method, thus there is not enough skilled expertise for its construction and it means time and money spending to build it.

5.5.1.2 Architectural aspects analysis

Due to its shape, Monolithic Dome results in very oddly shaped room divisions that result in waste of space at the corners. It is not yet accepted as a common residential place because people still have not accepted a hemisphere for a house. It requires a larger footprint for the same area of standing area compared to a shelter with vertical walls.

5.5.1.3 Comfort analysis

As seen in the data achieved, the insulation of the building is more emphasized in the permanent houses than the emergency houses.

After the achievement of the comfort and expected design, the additional beauty can make the space more pleasing. The accessories used in the Sistema Arde, the semi-sphere shape of the domes, greenery coating of the Quinta Montoy Housing intensifies the aesthetic feature of the houses, thus people feel more at home.

6. CONCLUSION AND RECOMMANDATIONS

To overcome the abundant plea of emergency shelter, we need firstly understand the shelter concept and its category. Furthermore, to provide the shelter needed, one has to consider users' expectations. The expectations change according to the culture, condition, society, economy and so on, but some of the expectations are mutual needs. The patterns derived of the compared examples can lead designers to find a solution for more qualified and acceptable shelters. The assessment result can help to the building shelter community and to decide which type of shelter is ranked highest in satisfying users and designers.

As a result, emergency shelters containing tents and paper shelter with structures that offer little protection from outdoor elements and have little sense of personal space. Considering the importance of the time factor in the emergency shelter, the following examples of the survey show the inefficiency of providing adequate emergency. The other problem facing in building emergency shelters is to provide a site for deploying. In areas with the enough suitable topography, there would be more chance in erecting shelters. Paper shelters with the same properties of the tents are recently patent shelters with more flexibility. They can be expanded over the time and create more space to satisfy the users until the temporary housing is getting prepared.

Temporary shelter is something more than a tent, but less than a permanent house. Unlike tents, they are rigid, fully enclosed structures, complete with doors and windows. Temporary houses are constructed according to the primitive concept of providing low-cost flexible houses with the purpose of being used in specific course of time. Yet, they are expected to be stable to various conditions. Referring to the table of temporary housing alternatives can help architects to choose the best items of shelter designing for a special zone.

For the temporary shelters that can be converted to permanent, the shelters are predicted to be incremental. Materials, design and the structure of the shelters have to

be stable enough and have the capacity to be expanded. This flexibility is a controversial item architects are emphasizing. It is an opportunity to design according to people's wish and fulfill their expectations.

In the emergency phase, cultural aspects play no major role. Where the shelter some privacy capabilities, this is sufficient for the user in the first instance. In an emergency it is not important how the shelter looks like, if it offers a warm and dry shelter they are already more than satisfied. Only in the transitional and permanent phase will be important cultural values and social interactions find meaning.

6.1 Future Research

This research is a first step to the sheltering patterns extracted through the experiences of the examples undertaken in various conditions. The patterns primitively need to be identified of the universal shelters. The general patterns will act like modular. They are fixed and identified but as they are situated and are attached to each other in various setting, they will form different shapes and functions that will finally come into sustainability; this is the overwhelming concern at present time and is a newly controversial discussion. To extract the clue of each pattern, there will be a long process of survey and observation. The patterns are flexible rules implemented everywhere, but they can be changed according to the condition for a more flexible architecture. The variety of forms removes monotony and is more pleasant.

6.2 Future Research Questions

- Is Ideal emergency housing possible?
- How is the future emergency housing going to be?
- Is there a universal acceptable form of emergency housing/shelter?
- What prompts comfort for the user?
- How much privacy is desired?
- To what extent can they build the shelter themselves?

An endless list of these questions can be developed. The answer to these questions differs with regard to country, region, culture and climate. Different groups of users

make different demands on their shelter. There is not a universal solution to be devised that can meet the diverse needs of the refugees.

In this research not all the patterns of the emergency housing is mapped, but those emphasizing the quality of the shelter and the factor of time.

However, a big bunch of patterns is still lacking. Therefore, for the next step in the process is to analyze social, technological, economic, environmental, cultural, political, legal and ethical factors of each zone to come across to a good and qualified shelter.

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